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AGRICULTURAL REVIEW

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VOL. VII JUNE, 1914 No. 6

The Philippine Agricultural Review

SPECIAL ARTICLES

SUGAR MANUFACTURE

By C. W. Hines

NEW VARIETIES OF ROSELLE

By P. J. Wester

A MONTHLY PUBLICATION
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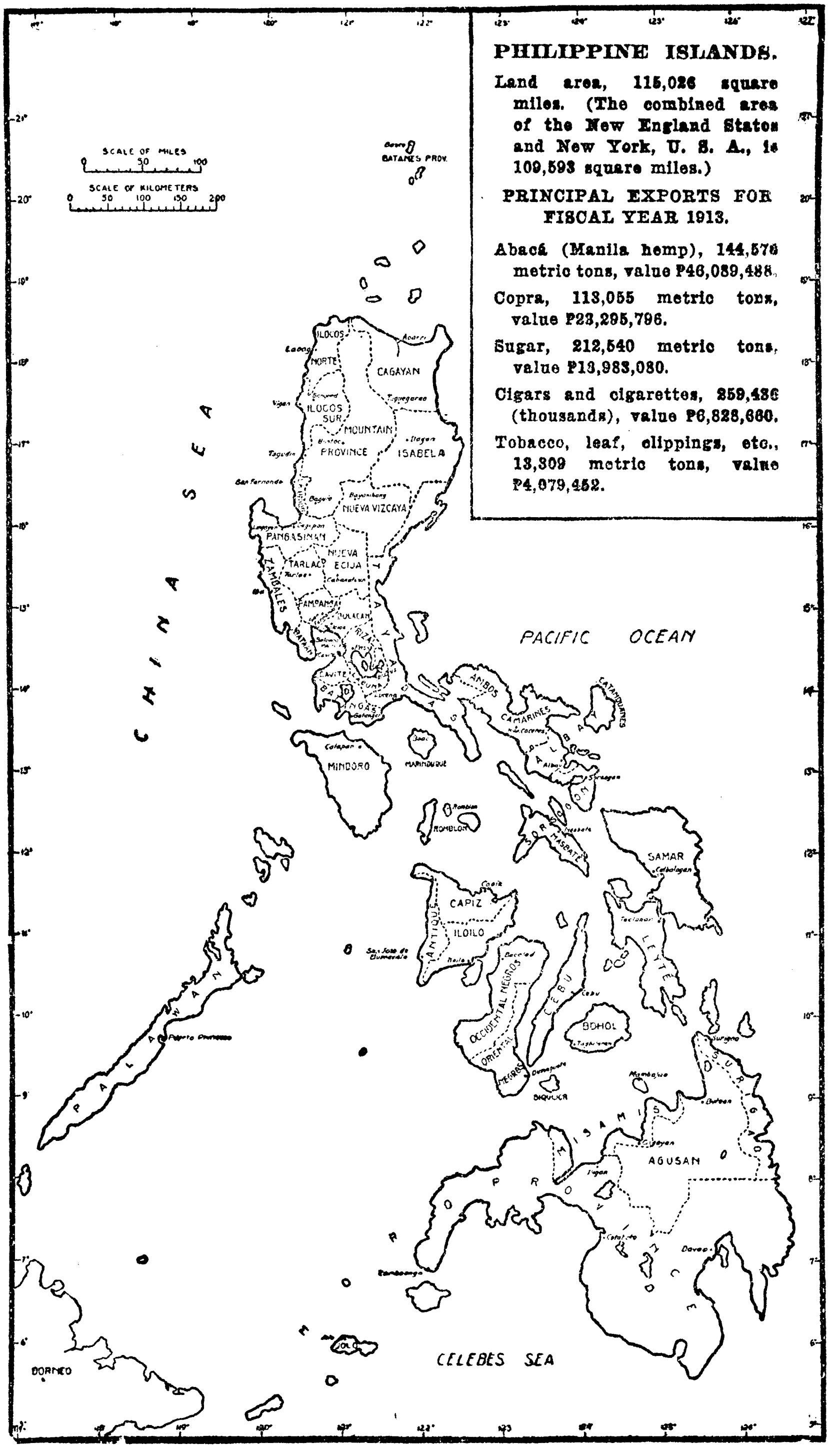


PHILIPPINE ISLANDS.

Land area, 115,026 square miles. (The combined area of the New England States and New York, U. S. A., is 109,593 square miles.)

PRINCIPAL EXPORTS FOR FISCAL YEAR 1913.

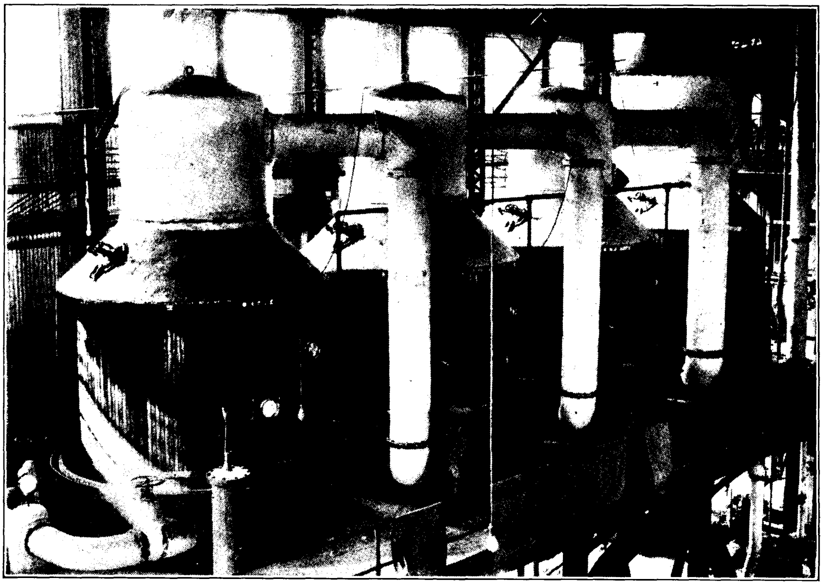
Abacá (Manila hemp), 144,576 metric tons, value ₱46,089,488.

Copra, 113,055 metric tons, value ₱23,295,796.

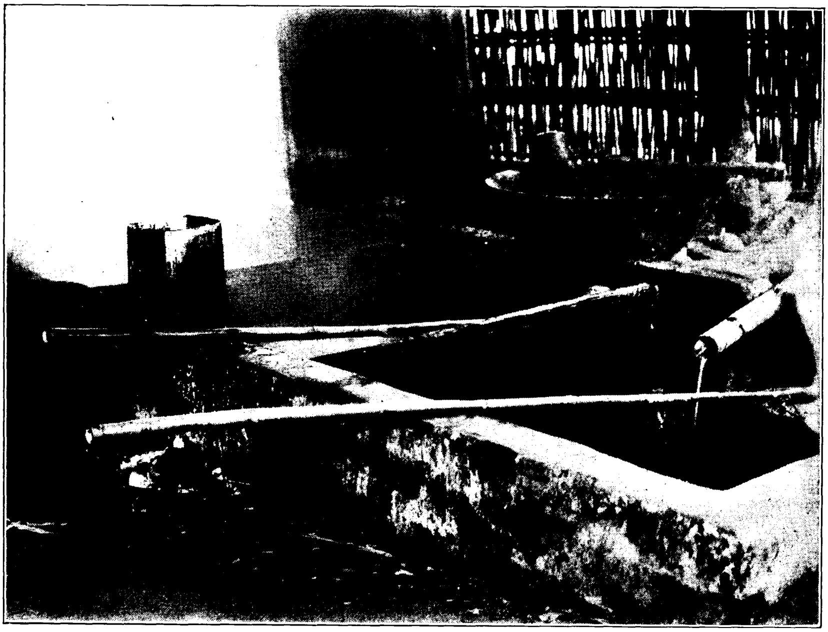
Sugar, 212,540 metric tons, value ₱13,983,080.

Cigars and cigarettes, 259,436 (thousands), value ₱6,828,660.

Tobacco, leaf, clippings, etc., 13,309 metric tons, value ₱4,079,452.



(*a*) Modern evaporating plant used at the San Carlos sugar factory.



(*b*) Open-system evaporating plant used in the Philippines.

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O. W. BARRETT P. J. WESTER M. M. SALEEBY

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EDITORIAL.

FUNCTIONS OF THE BUREAU OF AGRICULTURE.

By the DIRECTOR OF AGRICULTURE.

The principal function of the Bureau of Agriculture, stated in the simplest terms, is to increase the wealth of the Philippine Islands by promoting the development of the agricultural resources of the country.

The foundation for this development work is careful and thorough investigation that shall determine means by which present conditions may be improved. A second, and equally important, step is to disseminate among the farmers the information obtained by investigation in such a way that this information will be utilized and will result in the production of larger crops and improve the live stock. A third feature of the work of the Bureau of Agriculture is such special public services as the rinderpest and locust campaigns, the public live-stock breeding, and the distribution of seeds and plants.

The work of the Bureau covers a very broad field of effort, and the men and money available for carrying on this work are limited. Under these conditions it is imperative, if results are to be obtained, that the resources of the Bureau be concentrated on a limited number of lines of work, even though such action may result in the apparent neglect of other matters deserving of attention.

For a number of years a large part of the funds and the forces of the Bureau have been concentrated on the rinderpest campaign. As a result of this action rinderpest, though not eradicated from the Islands, has been kept under such control and the area of infection has been so largely reduced that the actual losses from this disease have been a comparatively unimportant factor in our agricultural situation.

During the past two years it has been possible to enlarge the scope of work of the Bureau, particularly along the line of coöperative field demonstrations. With the transfer of the management of the rinderpest campaign to the governors of provinces, it will be possible to still further develop constructive lines of work.

For the past five years an average amount of ₱14,000,000 has been sent out on the Islands each year for the purchase of rice. This large and steady drain on the resources of the country for the purchase of food that could be produced in the Islands constitutes a most serious menace to the establishment of a condition of stable and permanent industrial prosperity. We believe that the development of the rice industry to at least that point where the Islands shall produce sufficient rice for local consumption is the most important work of the Bureau of Agriculture at the present time.

A rice campaign has, therefore, been organized and local officials throughout the principal rice-growing provinces have been requested to lend their support and aid to this work. A special force of Bureau employees will be detailed on this work, and every possible effort will be made to promote the production of more and better rice in the Islands.

BUREAU OF AGRICULTURE CIRCULAR No. 30—CULTURAL DIRECTIONS FOR THE PAPAYA.

[CIRCULAR No. 30. Manila, P. I., April 28, 1914.]

CULTURAL DIRECTIONS FOR THE PAPAYA.

By P. J. WESTER, *Horticulturist in Charge of Lamao Experiment Station.*

Preliminary remarks.—The papaya is one of the commonest fruits in the Philippines, ranking next to the banana with respect to wide distribution, largely because of its rapidity of growth and early fruiting habit as compared with other fruits.

The papaya is a large succulent herb, of exceedingly rapid growth, and when well cared for produces ripe fruit within twelve months from the planting of the seed. It is very impatient of water standing around the roots and succeeds on well-drained land, sandy or loamy soils being most suitable; as it is easily injured by strong winds the papaya should be planted in well-sheltered situations.

From the grower's point of view there are three kinds of papayas: The hermaphrodite papaya, the flowers of which are perfect; the pistillate, or, as it is commonly called, the female papaya; and the staminate, or male, papaya. Of the two fruiting kinds, the hermaphrodite is preferable to the female since it is usually sweeter and better flavored; a very great point in its favor is the fact that it is more apt to reproduce itself true to seed than the female.

The hermaphrodite papaya is distinguished by its more or less oblong or pear-shaped form, sometimes, in its best types, approaching the shape of a cucumber. The female papaya is recognized by its more roundish shape, prominent "nose," and a large seed cavity that frequently is filled with seed.

Propagation.—The seed bed should be prepared by thoroughly pulverizing the soil by spading or hoeing the ground well and clearing away all weeds and trash. The seed should be sowed thinly, about 1 to 2 centimeters apart, and covered not more than 1 centimeter deep with soil, and the bed then watered thoroughly. In the dry season it is well to make the seed bed

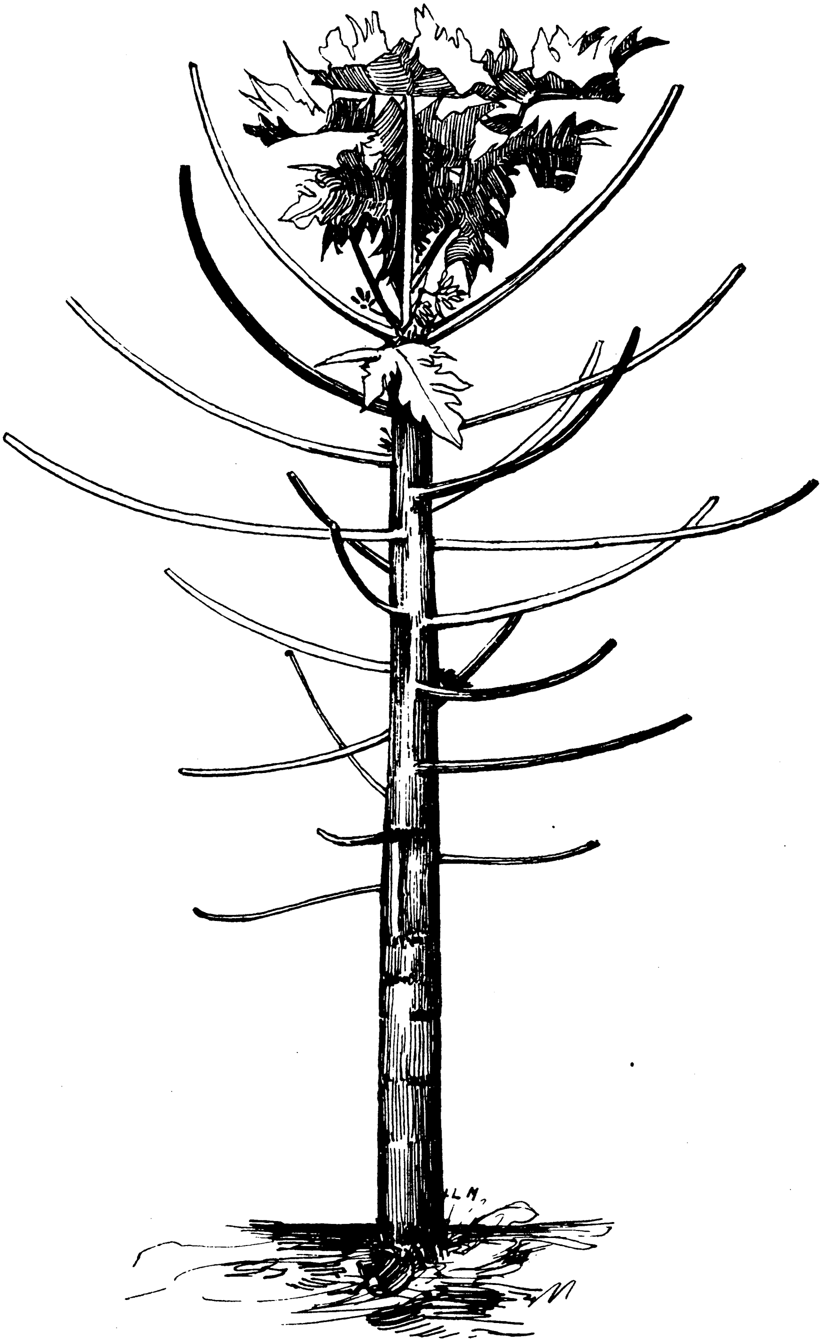


FIG. 1. The correct way of pruning a papaya plant before transplanting.

where it is shaded from the hot midday rays of the sun, for example, under a tree; or, it may be shaded by the erection of a small bamboo frame covered with grass or palm leaves. If the seed is sown during the rainy season a shed should always be put up over the seed bed to protect the seed from being washed away and the plants from being beaten down by the rains.

Transplanting the seedlings in the seed bed, setting them about 7 to 10 centimeters apart, when two or three true leaves have appeared, will very materially aid in the successful transfer of the seedlings to the field.

Transplanting to the field.—When the plants have attained a height of about 7 to 10 centimeters, they are ready for transplanting to their permanent place in the garden or the orchard.

Unless the transplanting has been preceded by a good rain, the plants should be thoroughly watered before they are removed from the seed bed. In order to reduce the evaporation of water from the plants until they are well established in their new quarters, about three-fourths of the leaf blades should be trimmed off.

In transplanting, take up the plants with a large ball of earth so that as few roots as possible are cut or disturbed. Do not set the young plant deeper in the new place than it grew in the nursery; firm the soil well around the roots, making a slight depression around the plant to hold water, and then give it a liberal watering.

In order to protect the tender plant from the sun until it is established, it is well to place around it a few leafy twigs at the time of planting. Unless the seed is of an unusually good strain it is also a good plan to set out two or three plants to each "hill." This gives the grower a better opportunity to discard male and undesirable female plants without destroying the "stand," than if only one plant is set out in each place.

If the plants can not be set out in the field at the time indicated, transplant them from the seed bed to the nursery, setting the plants 30 to 40 centimeters apart in rows 1.2 meters apart, or more, to suit the convenience of the planter. While the best plan is to set out the plants in the field before they are more than 30 centimeters tall, the plants may be transplanted from the nursery to the field with safety even after having attained a height of 2 meters, *provided that all except the young and tender leaf blades are removed, leaving the entire petiole or leafstalk attached to the plant,* as shown in figure 1, and provided that, in those regions where the rains are excessive

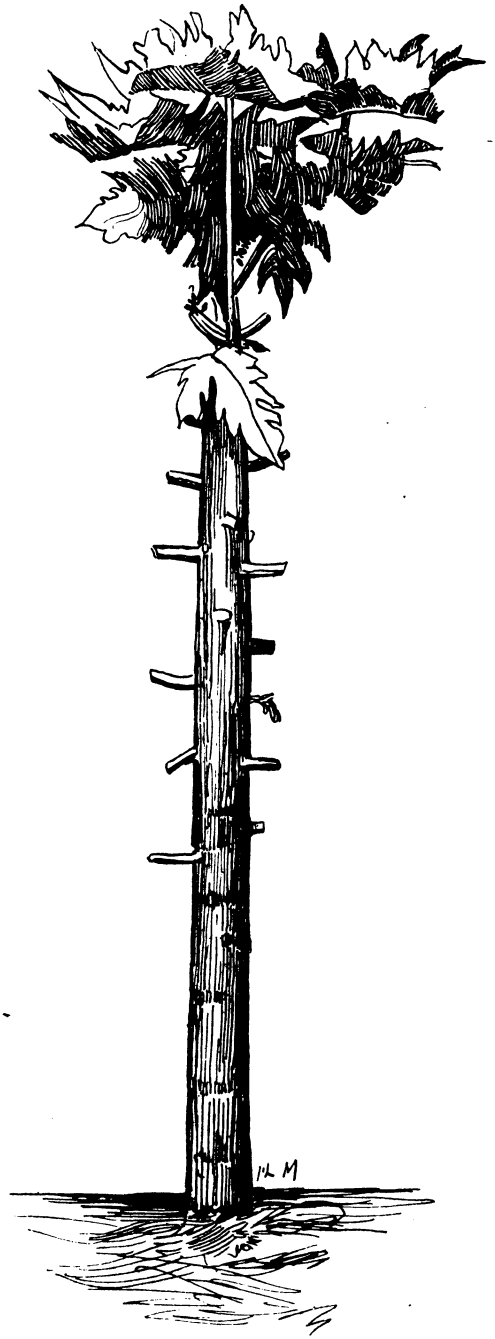


FIG. 2. The incorrect way of pruning a papaya plant before transplanting.

during the wet season, the work is performed during the dry season. If the entire leafstalk is left on the plant it withers and drops and a good leaf scar has formed before the fungi have had time to work their way from the leafstalk into the stem of the plant. As the tissue of the papaya plant is exceptionably favorable for the rapid development and spread of fungi, if the leafstalk is cut off *close to the stem* as shown in figure 2, the fungi invade the stem from the remaining short petioles and the plant dies.

Papayas should be planted 4 meters apart each way on land of average fertility; on very rich land it may be desirable to set out the plants 4.5 meters apart.

Culture.—While the plants are small the intervening space may be planted to some upright-growing cover crop, such as mongos or cowpeas, but when the papayas come into fruiting the best plan is to keep the land clean cultivated during the dry season. For the best success it is essential that the plants are irrigated whenever the leaves show signs of wilting, and being of exceedingly rapid growth the papaya requires more water than most plants. In order to reduce evaporation and irrigation expense, the land should be cultivated as soon as it is in condition for cultivation after the flooding. The harrowing may be repeated once or twice before the field is again irrigated.

During the rainy season special attention should be given to see that there is no stagnant water in any part of the papaya plantation, and that all surface water drains off rapidly.

Rejuvenation of old plants.—When a plant has grown so tall that it is difficult to gather the fruit, which also at this stage grows small, cut off the trunk about 0.75 to 1 meter above the ground. A number of buds will then sprout from the stump (fig. 3), and in a surprisingly short time the old stump will have been transformed into a papaya plant in full bearing. These sprouts, except two or three, should be cut off, for if all are permitted to grow the fruit produced will be undersized.

Seed selection.—Seed should be saved from the best fruits only. By this is meant not so much a large fruit as one that is *sweet and well flavored,* with a small seed cavity and few seeds. Oblong should be preferred to round fruits in saving seed, since they grow on plants having both stamens and pistils in the same flower, and these being very largely self-pollinated, the seeds produced from such flowers are more likely to reproduce their kind than the seed from round or melon-shaped fruits, which grow mostly on female plants.

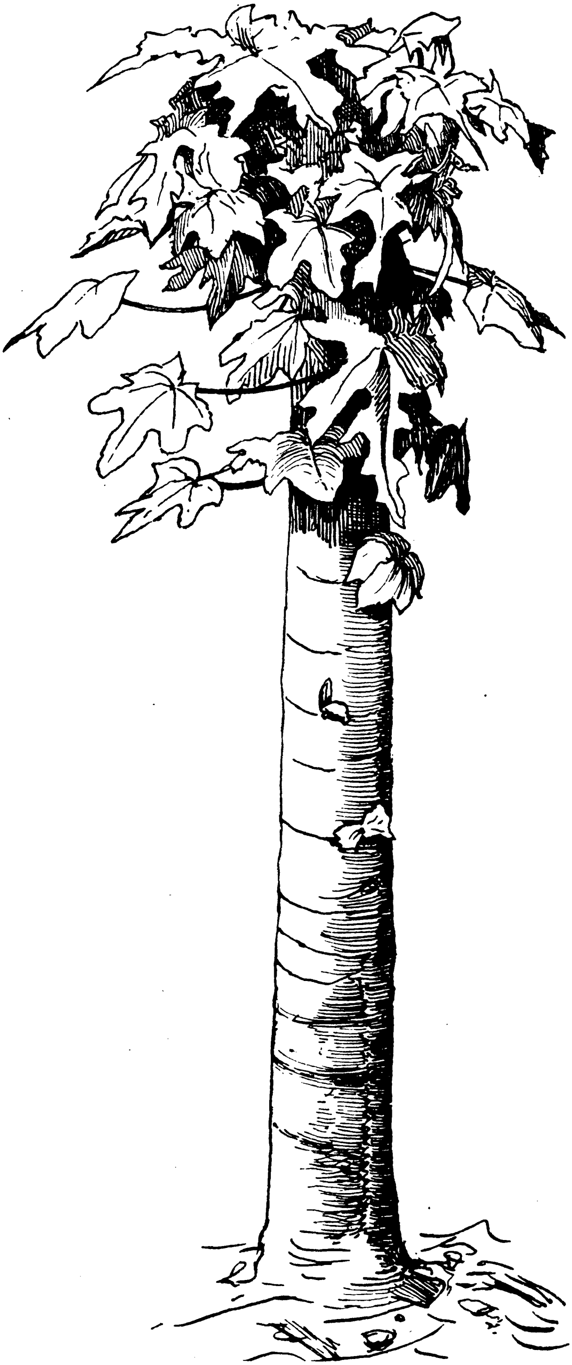


FIG. 3. Stump of old plant a few weeks after "decapitation."

All male plants should be promptly destroyed wherever they appear, as not only are they unproductive, but by their pollen being carried to others which are fruiting they tend to produce degenerate plants when these are grown from the seed obtained from plants growing in the vicinity of the male plants. There is no need to fear that the others will not fruit if the male plants are destroyed, for the reason that there are always plants near by having *perfect* flowers which provide sufficient pollen for the pollination of the females.

SUGAR MANUFACTURE.

By C. W. HINES, *Station Superintendent.*

[Continued from the February number of the AGRICULTURAL REVIEW.]

Evaporation of the juice.—The juice leaving the clarifying and filtering apparatus is now ready for concentration. Formerly this was done in open pans under atmospheric pressure, and indeed this method is still practiced in the old native factories of these Islands, including, perhaps, 90 per cent of all the factories here. The troubles resulting from this method are many. Sucrose has the peculiar property of being broken up into the two components of inverted sugar—dextrose and levulose—upon prolonged heating to a high temperature, but when this temperature is continued very high for some time, other decomposition products are formed, among which is caramel. Now this caramel lends a dark color to the juice which is very difficult or almost impossible to remove, except by the use of animal charcoal or the boneblack process.

An improvement over this system of evaporation was effected with the introduction of a steam space above the directly heated part, or coils, and sometimes tubes inside this, whereby steam might be used instead of the direct flame. This, of course, had the tendency of preventing the superheating of these vessels to such a great extent, which lessened the danger caused by excessive heat but by no means entirely removed it.

The writer has conducted a series of experiments in various open-kettle systems throughout the Philippines to determine the temperature to which the metal open evaporators are raised, and finds that it sometimes goes as high as 135° C. Heavy sugar solutions will meet with very disastrous results at such a high temperature, if this heat is continued for some time, which is necessarily the case where heavy massecuites are being boiled.

The more modern apparatus for this particular work is the "vacuum evaporator," the original type of which contained but one member. A little experience with this type of apparatus proved that the steam leaving this member could be used to boil the juice another time, provided the vacuum be increased the proper amount in the succeeding effect. From these experiments the double, triple, quadruple, and even sextuple effects have been evolved. They are made either in the form of vertical or horizontal evaporators.

Another great advantage in using such a system of evaporators is that exhaust steam from the various engines in the factory may be used again in this apparatus and thus a great saving in fuel effected. In a properly managed factory, equipped with triple or quadruple effects, usually enough heat is recovered in this manner from exhaust steam to boil all the juice to a heavy sirup ready for the pan.

The principle involved in this process is as follows: The juice is allowed to flow into the juice space of the first member by gravity pressure from the juice-supply tank until the proper level is reached. This amount must be determined for each particular class of evaporators, but in general it is most economical to boil as low as possible, thus reducing the effect of the so-called "hydrostatic head," or juice pressure from above. The vacuum pump is then started and a vacuum of 22 to 26 inches (560 to 660 millimeters) maintained in the last member. Exhaust steam from the engines with a pressure of about 5 pounds per square inch is now turned into the calandria or heating space of the first member. This causes the juice to boil at atmospheric pressure, or 100° C. (212° F.). The valve in the pipe line connecting the juice space of the first with that of the second effect is now opened and juice from the first member allowed to flow into the second. The juice in each member of the effect will flow to the next by reason of the increased vacuum. The vapors from the boiling juice in this first member pass through the large pipe leading into the calandria of the second member. These vapors enter at a temperature of about 100° C., and, of course, could not cause the juice to boil unless the pressure be reduced, consequently a vacuum is maintained in the juice space of this effect so that the boiling temperature will usually be reduced to 90° C. (194° F.). The valve of the pipe line connecting the second and third effect will now be opened and juice allowed to flow into that member, and the steam from the previous member conducted to the calandria of this member as in the previous case, since this steam has a temperature of but 90° C., the vacuum will have to be still further increased in order for this material to boil. The same principle is carried out for any number of members in the effect.

The vacuum pump and condenser are placed only after the last member, since the tubes in each of the others act as surface condensers and thus cause a partial vacuum to be formed.

Condensers.—The apparatus used for condensing the steam in sugar-house work is usually of the jet type of condenser. They are ordinarily arranged so that the water passes in the same direction as the steam and are consequently called parallel-current condensers. Another type sometimes used is the counter-current condenser, in which the water is sprayed in at the top while the steam enters at the bottom. The vacuum is produced by the condensation of the water vapors, thus causing them to occupy less space. It is also produced by the pumps, which not only remove water but gas as well, except when employed as dry-vacuum pumps, in which case they are used to remove gases only.

The modern factories, built to-day, are usually equipped with quadruple effects. The great Calamba and San Carlos factories offer examples of this class. Triple effects doing most excellent work have recently been installed at the Dinalupihan factory in Bataan Province, and Tia Eugenia, in Iloilo Province. The last member of an effect usually has a vacuum of about 25 inches (640 millimeters) mercury when it is working properly. Under these conditions water will boil at a temperature of 56°C. (130°F.). Since heat is a destroyer of sucrose, it will very readily be seen what a great improvement vacuum evaporators are over the old open-train type.

In operating evaporators the valves may be set so that a constant flow of juice is maintained from one effect to the other, and consequently little attention will be required to operate them.

Evaporators are made in two general classes—vertical and horizontal. They may be further classified as submerged-tube, film, etc., evaporators.

Vertical effects.—These are so-called since they, as well as their tubes, are arranged vertically. All of the evaporators the writer has observed among the different sugar factories of these Islands are of this type.

Horizontal effects.—These are so-called from the fact that the tubes are set in a horizontal position. The Swenson evaporator forms an example of this type, the most modern of which has recently been installed in the Adeline sugar factory of Louisiana. Either of the above-named types may be constructed in the submerged-tube or film styles.

Kestner evaporator.—This is a distinct style of vertical evaporator designed to give a greater coefficient of heat transmission, since the juice remains only a short time under treatment. A new evaporator of this style is now in operation at the Guanica sugar factory in Porto Rico. The writer has seen this style of evaporator used as a preheater to increase the evaporating capacity of the factory, where excellent results were reported.

Lillie evaporator.—This apparatus has a peculiar design, since centrifugal pumps are used as a circulating medium to keep the juice flowing over the horizontally arranged tubes, and it may also be reversible with regard to steam as well as the juice. This has the effect of keeping the tubes clean for a much longer period, thus diminishing the amount of work required as well as increasing evaporator capacity. It is one of the best types of film evaporators, as the hydrostatic head is entirely removed.

The Guanica factory of Porto Rico is equipped with three sets of quadruple effects of this type, capable of evaporating 40,000 gallons (1,514.17 hectoliters) of mixed juice each to a sirup of 30 Baumé in twenty-four hours. Also the new Meeker sugar factory of Louisiana was recently equipped with a quadruple effect of this type.

One is somewhat surprised to find an apparatus which is usually used in the sugar house speeding about over the great ocean, handling an entirely different substance and turning out in this case, as the finished product, vapors of pure water, which in the sugar house was an entirely waste product. The U. S. steamer *Dixie* was recently equipped with reversible quadruple effects of this style for the purpose of evaporating salt water from the sea. A surface condenser is used in this case, since the vapors must not become contaminated with the water used for this purpose. The 950 square feet of heating surface in this apparatus have a capacity of 25,000 gallons (946 hectoliters) in twenty-four hours.

Weber evaporator.—This is perhaps one of the newest designs in evaporators and presents several features radically different from other makes. It is built as a vertical effect and particular attention is given to the circulation of steam over the heating surface, thus giving a high evaporating coefficient. The Vermillion factory of Louisiana has been using this style of evaporator the past two campaigns, and reports it as an entire success. In this type, as well as in the Sanborn, special attention is given to the removal of noncondensable gases from the steam space; as air is a nonconductor of heat it forms a factor worthy of consideration.

Professor Kerr states:

> The capacity of evaporators with a given area of heating surface depends upon a great number of factors, some of which are common to all evaporators irrespective of design, while others depend upon the design. Among the former may be mentioned pressure of steam applied to the first body, vacuum in last body, cleanliness of heating tubes, difference between the temperature of the heating steam and the boiling liquid, etc. Among the latter may be mentioned the effect of design upon the fouling of tubes, hydrostatic head, distribution of steam, removal of air and other noncondensable gases from the steam compartment, removal of condensed steam from the steam compartment, velocity of steam, velocity of juice circulation, joints through which air may leak, strength against collapsing pressure, etc.

It may readily be seen that there are numerous factors to be considered in the installation of one of these apparatus. While it is not the purpose of this article to go deeply into the subject of various designs of evaporators, yet it has been thought wise to call attention to a few facts on the subject which have a great bearing on the future of the Philippine sugar industry.

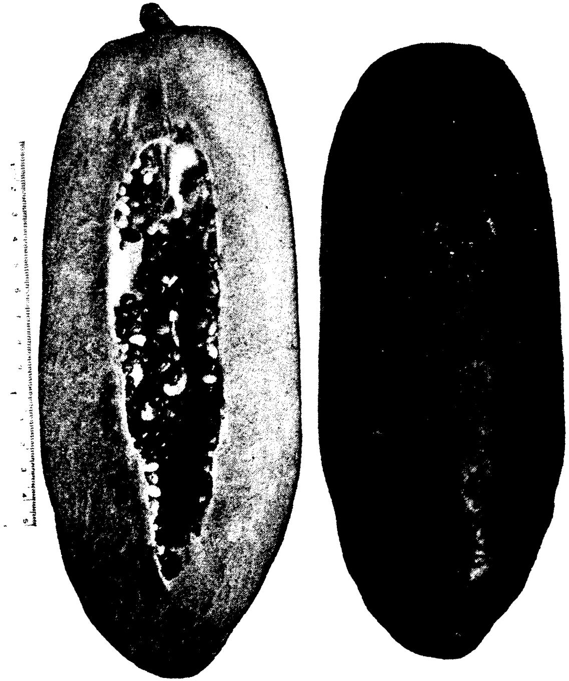
Entrainment.—One great source of loss often encountered in the working of evaporators is that of entrainment—that is, the passing over of small particles of sweet liquor with the vapors into the steam space of the succeeding effect, or into the condenser. This may be reduced by means of "catchalls," containing baffle plates which check the velocity of the passing vapor, and thus cause the entrained particles of juice to be deposited. Aside from this loss of sucrose, a very disastrous thing may result in the boiler house if these condenser waters are used as boilerfeed waters, which is quite often the case.

Sucrose heated under conditions found in the boilers decomposes very rapidly, forming most powerful gases, which often cause the boilers to explode. The presence of sucrose here may sometimes be detected by the peculiar odor evolved or by the delicate chemical tests enumerated later. In any event, the only safe thing to do when sugar is suspected in the boilers is to change the water as soon as practical and see that a fresh supply of water for future use is available.

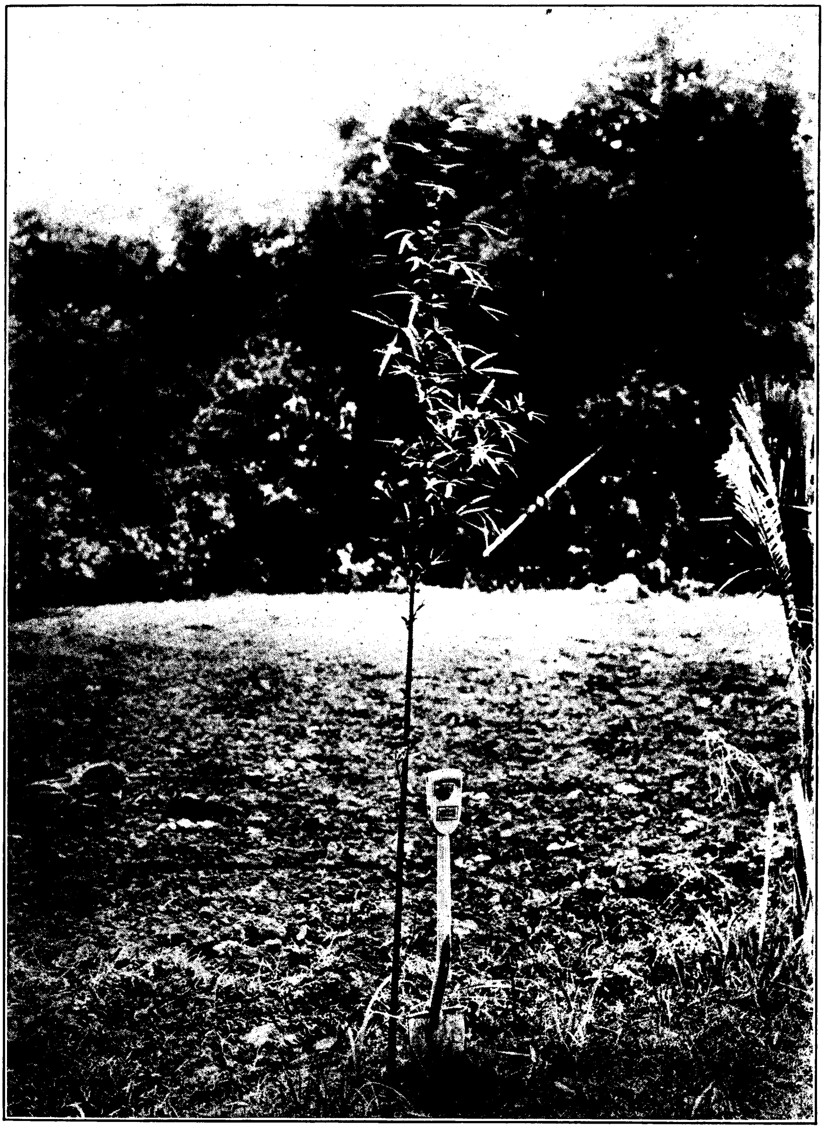
This escaping sugar should also be located immediately in order to prevent any further loss in the particular station. Where condenser water is used exclusively for boiler feed, laboratory tests should be made on these feed waters at least every hour or half hour. These tests require but a few minutes of time and may often not only save a boiler-house plant, but a great deal of sucrose as well.

PLATE II.

(*a*) A young hermaphrodite papaya plant coming into bearing, Lamao experiment station, 1913.

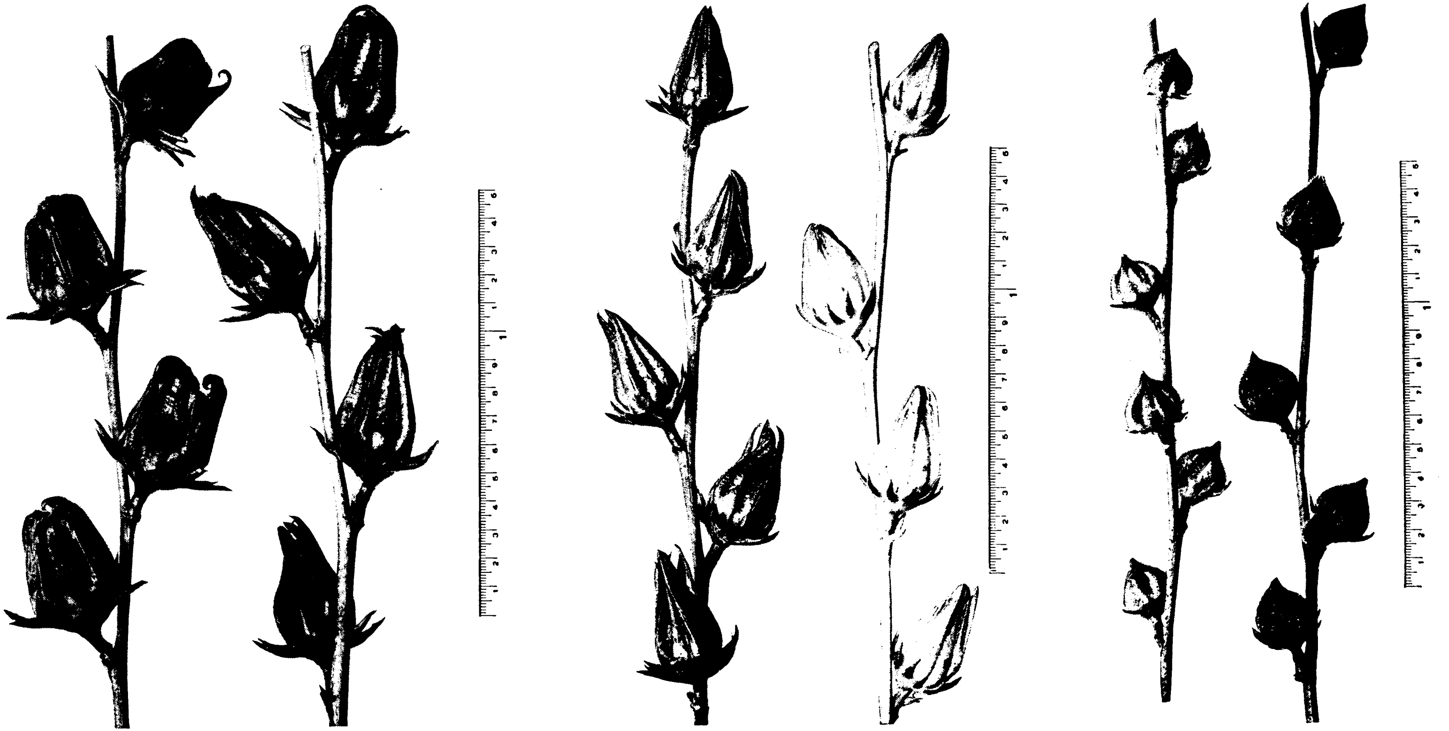


(*b*) A well-proportioned hermaphrodite papaya.



Typical plant of "Altissima" roselle, Lamao experiment station, 1913.

PLATE IV.



(*a*) "Rico" at left; "Victor" at right; grown at the Lamao experiment station, 1913.

(*b*) "Temprano" at left; "Archer" at right; grown at the Lamao experiment station, 1913.

(*c*) "Altissima" roselle; intermediate type at left; red type at the right; grown at the Lamao experiment station, 1913.

TYPES OF ROSELLE.

Typical plant of "Archer" roselle at the Lamao experiment station, 1913.

There is usually a very large volume of water used in condensing these vapors, and consequently quite a considerable amount of sucrose might be overlooked unless a vigilant eye is kept on the control of this part of the work. It is never safe to consider that no loss is encountered by reason of the many tests made on previous days or, indeed, on the same day. Carelessness here on the part of the operator or because of something going wrong with the working apparatus may cause an excessive bumping about of the juice, or the juice level may be allowed to go so high that a great quantity of sucrose will be lost in a very short time.

Method of testing condenser waters for sucrose.—This may be done by various chemical methods, but the two given below are the most simple and with proper attention will give satisfactory results.

Alpha-napthol test for sucrose.—Place about 6 cubic centimeters of the sample in a test tube with a drop or two of an alcoholic solution of alpha napthol. Then tilt the tube slightly and carefully pour down the side about 2 cubic centimeters of concentrated sulphuric acid. If sucrose is present a violet-colored ring will form where the two liquids meet. This is a very delicate test for sucrose, but the intensity of the ring formed will give the relative amount of sucrose present, and if the ring is sufficiently heavy a sample should be sent to the laboratory for polarization. In the meantime such changes should be made in the boiling plant as will correct this loss of sucrose.

Fehling's-solution test.—One hundred cubic centimeters of the sample may be reduced to one-tenth of the original volume by evaporation and this boiled for a few moments with a few drops of concentrated hydrochloric acid. It is then neutralized with sodium carbonate and heated again, after receiving two or three drops of mixed Fehling's solution. In this case a red precipitate will reveal the presence of inverted sugar which was derived from sucrose.

Sirup.—The juice is usually concentrated in the effects to about 25 or 30° Baumé, which means a Brix reading of about 50° and a total solids of 50 per cent. There is no set rule for the density to which the sirup may be boiled. This depends very much upon the individual desires of the sugar boiler, and also the supply of exhaust steam available. Where a great deal of this waste steam is available there is no particular reason why the sirup cannot be boiled quite heavy, and due consideration given to this point by the man in charge of the pan floor. Heat units saved in this manner can readily be calculated in pesos for the manufacturer, and quite often strict attention given to the smaller details of the work throughout sugar manufacture is responsible for one man's success in a factory where others have made a complete failure.

One thing further in regard to these sirups. It is a most excellent practice to have a cylinder and Brix or Baumé spindle near the evaporators so that the man in charge may test each charge of sirup before turning it out to see that all has a uniform density. This is a very important factor and will greatly aid the man in charge of the pan floor in properly handling the thick liquor if he can always depend upon a uniform article.

In regard to the different methods of calculating the density of this thick liquor the Brix spindle gives the approximate percentage of total solids or total dry matter. This is the proper spindle to be used in all sugar-house work, but unfortunately another, the Baumé spindle, is used a great deal and therefore further explanation here will be in place. This spindle was made without any reference whatever to the sugar work. Degrees Baumé, then, are only relative terms when applied in this work, but can be referred to total solids and specific gravity from the following table:

Degree, Baumé.	Brix.	Specific gravity.	Degree, Baumé.	Brix.	Specific gravity.	Degree, Baumé.	Brix.	Specific gravity.
0.5	0.9	1.00349	13.5	23.9	1.10099	26.5	47.7	1.2201
1.0	1.7	1.00662	14.0	24.9	1.10560	27.0	48.6	1.2250
1.5	2.7	1.01055	14.5	25.8	1.10979	27.5	49.6	1.2305
2.0	3.6	1.01371	15.0	26.7	1.11400	28.0	50.5	1.2355
2.5	4.4	1.01730	15.5	27.5	1.11824	28.5	51.4	1.2405
3.0	5.3	1.02091	16.0	28.5	1.12250	29.0	52.4	1.2461
3.5	6.1	1.02413	16.5	29.4	1.1267	29.5	53.4	1.2517
4.0	7.0	1.02779	17.0	30.3	1.1311	30.0	54.3	1.2568
4.5	7.9	1.03146	17.5	31.2	1.1354	30.5	55.2	1.2620
5.0	8.8	1.03517	18.0	32.2	1.1403	31.0	56.2	1.2677
5.5	9.7	1.03889	18.5	33.0	1.1442	31.5	57.2	1.2735
6.0	10.6	1.04264	19.0	33.9	1.1486	32.0	58.2	1.2793
6.5	11.4	1.04599	19.5	34.8	1.1531	32.5	59.0	1.2840
7.0	12.3	1.04979	20.0	35.7	1.1576	33.0	60.0	1.2898
7.5	13.2	1.05361	20.5	36.6	1.1621	33.5	61.0	1.2958
8.0	14.2	1.05789	21.0	37.5	1.1666	34.0	61.9	1.3011
8.5	15.0	1.06133	21.5	38.5	1.1712	34.5	62.9	1.3070
9.0	16.0	1.06566	22.0	39.4	1.1763	35.0	63.9	1.3132
9.5	16.9	1.06958	22.5	40.4	1.1815	35.5	64.8	1.3186
10.0	17.7	1.07309	23.0	41.3	1.1861	36.0	65.8	1.3247
10.5	18.7	1.07751	23.5	42.2	1.1908	36.5	66.9	1.3315
11.0	19.5	1.08106	24.0	43.1	1.1955	37.0	67.9	1.3377
11.5	20.3	1.08464	24.5	44.0	1.2003	37.5	68.7	1.3427
12.0	21.3	1.08914	25.0	44.9	1.2051	38.0	69.7	1.3489
12.5	22.2	1.09321	25.5	45.8	1.2009	38.5	70.7	1.3553
13.0	23.0	1.09686	26.0	46.8	1.2153	39.0	71.7	1.3616
13.5	23.9	1.10099	26.5	47.7	1.2201	39.5	72.7	1.3680
14.0	24.9	1.10560	27.0	48.6	1.2250	40.0	73.7	1.3744

The following formula may be used for calculating the amount of sirup recovered from a given amount of clarified juice:

$$S=W\left(1-\frac{D}{D^1}\right).$$

S=amount of sirup recovered.
W=the number of pounds of thin juice.
D^1=total solids of the resulting sirup.
D=total solids of thin juice.

The amount of water evaporated from a given thin juice to make a sirup of a given density may be calculated from the following formula:

$$X=S\left(1\frac{C}{C^1}\right)$$

X=the weight of water to be evaporated.
S=the weight of thin juice.
C=the total solids of thin juice.
C^1=the total solids of the sirup.

NEW VARIETIES OF ROSELLE.[1]

By P. J. WESTER, *Horticulturist in Charge of Lamao Experiment Station.*

"Victor" (Plate IV, *a*), named by the writer in Florida in 1907, seems to have been the first distinct variety of roselle recognized and described.[2]

Howard, in India, isolated and described in 1912 the following types: "Ruber," "Intermedius," "Albus," and "Bhagalpuriensis."[3] The "Rico" (Plate IV, *a*) was also named and illustrated for the first time in 1912.[4]

The Victor and Rico were introduced into the Philippines by the writer in 1911, and, taking everything into consideration, have shown themselves superior to the several strains of the red type, to which these varieties belong, that have since then been introduced from various countries and tested. By continued rigid selection the calyces of the Rico have been enlarged, and this variety is now perhaps a somewhat heavier cropper than the Victor.

Hereinafter three varieties are described and named, one of which originated at the Lamao experiment station and two were introduced from abroad; neither of these seem to have been recognized heretofore under horticultural variety names.

TEMPRANO.

(Plate IV, *b*.)

Description.—Plant of medium vigor and upright growth, branching profusely, rarely exceeding 1.25 meters in height;

---

[1] For complementary articles on roselle by the same author, see Contributions to the History and Bibliography of the Roselle. Bul. Torrey Bot. Club, Vol. 38, pp. 91–98. 1911.

Roselle, Its Cultivation and Uses. Phil. Agr. Rev. Vol. V, No. 3, pp. 123–132. 1912.

Additional Notes on Roselle. Ibid. Vol. VI, No. 5, pp. 223–227. 1913.

[2] Wester, P. J.: Roselle, Its Culture and Uses. F. B. No. 307, U. S. D. A. 1907, pp. 9, 10; fig. 5.

[3] Howard, A., and Howard, G.: Studies in Indian Fiber Plants. Memoirs of the Department of Agriculture in India. Vol. IV; No. 2. 1912. pp. 32–36.

[4] Wester, P. J.: Roselle, Its Cultivation and Uses. Phil. Agr. Rev., 1912. Vol. V: No. 3, p. 126, Plate II.

stems light red; leaves palmately 5-lobate with conspicuously narrow lobes; flowers normal; pollen golden brown; calyx of the same general form as that of the Victor, but smaller, average length 45 millimeters, width 25 millimeters, with epicalyx 39 millimeters. The variety is prolific and the fruiting season is twenty days earlier than Victor and Rico.

When the Victor fruited for the first time at Lamao in 1911, one plant was conspicuous for its earliness, and seed was saved from this plant and sown the following year. The early trait of the parent was transmitted to the progeny, and the earliest plant was again isolated and the seed sown in 1913. In harvesting the fruit and seed of the third generation, the early habit and other characteristics that distinguish this new strain from its parent, the Victor, seem to be sufficiently well fixed to merit it recognition as a separate variety, and it has been named "Temprano" on account of its early habit.

The Temprano is more subject to leaf-blight than any of the varieties mentioned in this paper, and therefore, and on account of its deficiency in vigor, it is not recommended for planting on a large scale. In fact, the Temprano is of more value in a subtropical than a tropical country, where early frosts at the approach of the cold season destroy the ordinary varieties before their fruiting season is over.

ARCHER.

(Plate IV, *b*.)

Description.—Plant robust, frequently exceeding 1.60 meters in height, branching freely, all parts of the plant being greenish or whitish; stems nearly smooth; leaf lobes rather narrow; flowers smaller than those in the red types; "eye" yellowish; pollen pale yellow; stigma green; full-grown calyx greenish white, sparsely covered with short stiff bristles; average length of calyx 45 millimeters, width 26 millimeters, including epicalyx 32 millimeters.

The Archer is very prolific, and the fruit is somewhat less acid than that of the red types, and the products made from it are whitish or amber colored. In the West Indies a wine is made from this variety that is said to resemble champagne in taste and appearance.

Seed of the above-described variety was received from Mr. A. S. Archer, Antigua, British West Indies, by the writer early in 1913, and it was tested at the Lamao experiment station the same year. It has been named in honor of Mr. Archer, with whom the writer has had the privilege of being in correspondence for many years, and who has greatly assisted the Bureau of Agriculture in the introduction of many useful and decorative tropical American plants.

The green type of roselle, to which the Archer belongs, was described as *Hibiscus digitatus* by Cavanilles in 1790, but it is now considered to be a form of *H. sabdariffa* L.

ALTISSIMA.

(Plate IV, *c*.)

Description.—Plant of upright habit, vigorous, attaining a height of 2.5, sometimes exceeding 3.5 meters, branching sparsely or not at all; leaflobes narrow; flowers normal; pollen golden yellow; full-grown calyces 25 millimeters long, 22 millimeters wide, including epicalyx 27 millimeters; calyx lobes thin and fibrous, and thickly covered with short, stiff bristles; seedpod almost totally filling cavity.

The above description applies to two varieties, seed of which was received by the Bureau of Agriculture from the Gold Coast, West Africa, in 1911, and which in some respects differ radically from all other forms examined by the writer. They differ from each other in that one kind belongs to the red type of roselle while the other form is intermediate between the red and the green. They evidently have no economic value in the Gold Coast, for our correspondent forwarded the seed with the remark that it was an "interesting plant."

Because of the fibrous and spiny character of the small calyces of the two forms belonging to the Altissima they have no culinary value. However, their habit of growth is favorable to the production of a long fiber, and according to Mr. M. M. Saleeby, chief of the fiber division of this Bureau, the two forms of Altissima are far superior to jute and all other varieties of roselle (including four from India) in habit, growth, and yield. As yet, the fiber of the Altissima has not been carefully studied, but it is apparently suitable for all uses in which jute fiber is now employed. The commercial possibilities of the fiber of the Altissima are now being investigated by Mr. Saleeby; the results will be published in a future issue of the Review.

In India roselle is grown chiefly for its fiber, and in a limited way it is considered as a food plant in the Old World Tropics, the equatorial belt of the Western Hemisphere, and Australia. According to Mr. W. E. Safford, Bureau of Plant Industry, United States Department of Agriculture, before the advent of artificial refrigeration the wealthy planters in certain parts of Mexico sent Indian runners to the snow-capped mountains in their neighborhood to bring down ice or snow for making roselle sherbet.

It may be of interest to readers in foreign countries to know that roselle soda water, roselle sundaes, roselle sherbet, and roselle ice cream are now included among the other standard offerings of a similar character in some of the best restaurants and ice-cream parlors in Manila, and it is confidently believed that if the roselle products were advertised and featured as, for instance, the (in the United States) famous "coca cola," it would be a question of only a short time when their real excellence would win for them general recognition; the culture of roselle would then become an industry of considerable importance among the minor crops of the Tropics and subtropics.

CURRENT NOTES—JUNE.

NOTES BY O. W. BARRETT, Chief, Division of Horticulture.

RECENT BANANA ACQUISITIONS.

Since the publication of the list of varieties in the Bureau's banana collection in the Philippine Agricultural Review for September, 1913, and January, 1914, the division of horticulture has been very fortunate in receiving several large collections of varieties which considerably augment the number of sorts under trial. The issue for September listed 276 varieties of bananas and plantains and 244 others were listed in the January number. The most noteworthy feature of the recent introductions is the large collection (68 varieties) from the department of agriculture of Papua, New Guinea.

This lot contains some of the very interesting and valuable sorts cultivated by the natives of Papua, who rely to a large extent upon these fruits for their subsistence; this is especially true of the hinterland regions of that great island, the native crops of which are not yet well known; there are probably a good number of varieties and perhaps some new types in this collection which will be quite new to the horticultural world.

Some of the peculiar "Fehis" of Samoa, Tonga, and Cook Islands are now nearly ready to fruit (for the first time in the Philippine Islands); the raceme, or fruit bunch, in these varieties (*Musa fehi*) *stands erect* instead of hanging downward. Another collection of these strong-growing half-wild "fehis" is promised by a descendant of the old kings of Tahiti, who as a plain planter has become much interested in the Bureau's plan to "try out" the best banana varieties of the whole world and to write them up in a practical bulletin for the future Philippine planter and shipper and perhaps also in a technical way for the manufacturer of banana products and for those who here and in other countries are interested in the more scientific phases of this rapidly broadening subject.

Bananas are at home here. Our tests will probably show that many varieties are not found outside the Archipelago. Within a decade or two, the Philippines can, it is believed, excel every other country in all banana matters except gross production.

The following list contains 112 varieties which brings the total collection up to 632.

Philippine bananas:
  Agispo.
  Balayang.
  Bognoran.
  Bo-oy.
  Buye.
  Bungulan Manok.
  Bungulan Tapidos.
  Buntungan.
  Balangai.
  Bolongbong.
  Damelig.
  Danayan.
  Dominus-vobiscum.
  Galatayan.
  Gao.
  Golo.
  Guinarangyan.
  Gulao.
  Higo (Fig banana).
  Lacnao.
  Lafitte.
  Luya.
  Loria.
  Maloko.
  Manang.
  Morong Dato.
  Pinanda.
  Padilat.
  Paranan.
  Potolan.
  Quialauan.
  Reina Blanca.
  Reina Colorada.
  Sabang Jolo.
  Sarocsoc.
  Toligsuk.
  Torangcog.
  Tucol.
China: Kowloon.
Cook Islands: Kauare.
Andaman Islands:
  Jungli.
  Red (wild).
Saigon:
  Chuoi hot.
  Chuoi tieu.
United States: Hart's Choice.
Hawaii: Hamakua.
Papua:
  Kaimale Faunga.
  Kiumaele.

Papua—Continued.
  Languma.
  Mamauga.
  Oanga.
  Vangofi.
  Vangeke.
  Angi-ia.
  Aiva.
  Alapa.
  Alelapu.
  Alu Alu.
  Apongekaua or Keameali.
  Faiele.
  Foame.
  Ifong Auki.
  Inia.
  Katea-ale.
  Lalu.
  Me-eu.
  Oite.
  Piritani.
  Uga.
  Tuliera.
  Haoni.
  Orea.
  Earua.
  Foipa.
  Imareoreo.
  Inauefae.
  Kaulama.
  Lapaki.
  He-eulapa.
  Ongopo.
  Pipikoio.
  Karoma.
  Amea.
  Ura-ura.
  Miria.
  Iami.
  Inefi.
  Kakaifa-a.
  Kufakaea.
  Malaive.
  Ngapi.
  Ofeoangaga.
  Ula-ula.
  Enhea.
  Paiera.
  Vailiara.
  Puba.
  Unidentified (17 varieties).

Four hundred and twenty-seven varieties are set out in the permanent test plat at Singalong experiment station and a large number of varieties are still in the propagating sheds. About 35 varieties are already in fruit at Alabang stock farm and one very distinct variety (*M. rosacea*) has just flowered at Singalong.

BANANAS IN INDIA.

Banana growers in India are becoming interested in the possibility of the banana-flour industry and in the near future it is probable that there will be a considerable production of by-product foods of this sort in evidence in that country. The great advantage of the flour, meal, chips, etc., is their adaptability to storage for the dry season and, at times, the famine-center trade.

LIVE STOCK IN ARGENTINA.

Argentina, always awake to the possibilities of the live-stock industry, has taken a new idea, presumably from the Western Australia precedent, and is now contemplating the introduction of camels. Large areas in this country are semiarid, but would undoubtedly be capable of supporting almost unlimited numbers of these valuable animals which would be of great advantage to the estate holders in the distant southern regions of the country where neither railways nor good roads have yet penetrated.

AFRIKANDER CATTLE IN CUBA.

Cuba has begun the importation of Afrikander cattle from South Africa. This peculiar breed of cattle, the origin of which is shrouded in mystery, will probably constitute an important introduction for the live-stock dealers of that country. The outcome of the infusion of the very vigorous blood of these cattle, which were found by the early explorers in vast herds from Zululand to the country of the Masai in British East Africa, will be watched with much interest.

EXPORTS FROM SARAWAK.

The export statistics from our neighboring country of Sarawak, in western Borneo, for the month of January, 1914, include several very interesting items. For instance, we are rather pleased to note that nipa sugar to the extent of 161 piculs was actually shipped out—a commentary on what might be done in this country; sago flour to the amount of 11,564 piculs, worth about ₱40,000, was also exported—just as might be done from the Agusan Valley every month of the year; cutch (a second-class dye and tanning material) in the amount of over 2,000 piculs, at about ₱6 per picul; also of gambier, another tanning stuff, over 1,000 piculs at about the same price as cutch. Beeswax to the extent of ₱1,200 and birds' nests (7⅘ piculs), worth about ₱275 per picul, were items which could be duplicated in this country. One of the heaviest exports, of course, is gutta; including the wild (jangkar and jelutong) and manufactured, the value for January was about ₱36,000. Plantation rubber came in with a value of about ₱26,000. Pepper is also in evidence to the extent of over ₱10,000 worth. "Tuba" appears in the sum of over ₱2,000. On the other hand, only about ₱1,000 worth of copra was shipped out.

NOTES BY P. J. WESTER, Horticulturist in Charge of Lamao Experiment Station.

EXPERIMENTATION VERSUS DEMONSTRATION.

Now and then we run across an article in a publication which, criticizing the work of the Government institutions pertaining to agriculture, maintains that much of the research work should be abandoned as unnecessary and more emphasis laid upon demonstration and extension work. As a matter of fact there is more need of research work, whether of a technical or a practical nature, in tropical agriculture than in this profession anywhere else, and demonstration and extension work must necessarily be based upon the data obtained by the experimenter. It is only by the patient and close study of a certain species, its peculiarities and response to certain climatic and soil conditions, various modes of culture, or certain methods of propagation, that these peculiarities can be taken advantage of and turned to profitable account for the benefit of the planter. Obviously then, not until better cultural methods for a certain crop, for instance, have been worked out experimentally, can demonstration work be effective or, in fact, be in order. Nor can the propagation of a certain species by means of a certain method, such as shield budding, hardwood or root cuttings or layering, be recommended or demonstrated to the planter until its possibility and practicability have been ascertained.

WASTE ON THE PLANTATION.

We quote the following timely paragraph from the Tropical Agriculturist:

> Waste on the farms totals a sum almost unthinkable in its magnitude. It is true that under present conditions much of the waste cannot be helped. But a gold eagle lost through a hole in the pocket is as much a loss as one deliberately tossed into the sea. The remedy would be to locate the hole and sew it up. Not long ago the agricultural commissioner of the Rock Island system published the statement that cornstalks made into ensilage were worth 60 per cent of the value of the grain and by wasting their stalks the farmers were losing 1 billion dollars (2 billion pesos) a year. It would not be necessary to go further if one were after an illustration of agricultural suicide. But another instance can be seen in the present wasteful system of ginning and baling cotton together costing the planters an unnecessary $10 (₱20) a bale, which on the crop of 1912 would aggregate at least 135 million dollars (270 million pesos). Applying to the crops of 1912, merely the difference in yield estimated by the Department of Agriculture (U. S. A.) between the use of heavy-weight and light-weight seed, this would make a difference of 750 million dollars (1,500 million pesos). The Department of Agriculture in the same country is sponsor for the statement that 1 million tons of tow could be saved from the flax straw that is now burned. In the grain States after threshing, the straw is burned to get rid of it; 70 million dollars (140 million pesos) gone up in smoke.

NOTES ON ADVENTITIOUS GERMINATION IN SOME EXOGENS.

In the November, 1912, issue of the REVIEW the writer called attention to the occurrence of adventitious germination in several species belonging to the family Dioscoreaceæ, and passing mention was made of the same phenomenon noted in *Annona cherimolia* Mill., *Rollinia orthopetala* A. DC., and *Uvaria rufa* Bl. With the right conditions spontaneous germination in exogens may not be as unusual as is commonly believed. Last year a number of ornamental plants were thinned out at the Lamao experiment station, among others *Sterculia foetida* L., *Enterolobium saman* Prain, *Delonix regia* Raf., *Peltophorum inerme* Naves, *Melia candollei* Juss., and *Canangium odoratum* Baill. The work was performed during the rainy season and under the great sap pressure a thick callus soon formed about the cambium layer of the tree stumps and from this a large number of growths issued that are now (April 20, 1914) 1.5 meters tall. In digging an irrigation ditch last year a root of a tree of *Annona muricata* L. was cut off, and after some months the root sprouted and is now developing into a healthy plant. At the subtropical laboratory, Miami, Florida, United States of America, the writer saw an adventitious sprout grow from the root of a mango tree about 0.75 meter from the trunk.

NOTES ON ROSELLE.

Mr. E. L. Worcester, whose roselle recipes were published in the May issue of the REVIEW, last year manufactured roselle products from 1.5 hectares (3 acres) of roselle, and considering the comparatively large scale upon which he operated, some of the figures relative to the manufacture and the quantities of the product obtained from a certain amount of the raw material, which Mr. Worcester has kindly placed at the disposal of the writer, should prove useful to prospective growers of roselle in its manufacture. Mr. and Mrs. Worcester made roselle sauce, sirup, jelly, and wine without any factory utensils, all the abovementioned products being strictly "home made" in the full sense of the word.

According to the figures submitted by Mr. Worcester, from 407 kilograms of fresh calyces were made 67 half-pint (0.23-liter) jars of jelly; from the waste of this material, consisting of seed pods and "butt ends" of the calyces, 112 pint (0.47-liter) bottles of sirup were made. Of another "batch" of 761 kilograms of fresh fruit were made 6 half-pint jars of jelly, 202 1½-pint (0.70-liter) jars and 269 half-pint jars of roselle sauce, 81 half-pint jars of roselle "butter," and 100 pint bottles of sirup. Three kilograms prepared fruit (equal to 6 kilograms of fresh fruit) and 4.5 kilograms of best refined sugar made 13 1½-pint jars of sauce. Nine to 12 half-pint jars of jelly were obtained from 3 kilograms of prepared fruit.

By heating the sugar to the point of melting and then pouring it into the boiling juice a harder jelly was obtained than if the sugar was *not* heated.

A NEW METHOD OF PREPARING SEEDS FOR MAILING.

Everybody conversant with the subject is well aware that the rapid loss of the viability of certain seeds of tropical fruits, such as the durian, the avocado, the mangosteen, marang, or the lanson, is due in a large measure to the invasion of fungi, and when these are excluded, provided that the seeds are otherwise properly packed in a medium of the right degree of moisture, there is really no sound reason why such seeds should not be successfully transported long distances, and retain their viability for a very considerable period.

Mr. E. D. Merrill, botanist of the Bureau of Science, who has recently returned from a journey to Java and Singapore, related to the writer that he saw in the Singapore botanical garden mangosteen plants grown from seed that were shipped from

Singapore to New York, United States of America, and from thence returned to Singapore, after which they were planted and gave a germination of 50 per cent. These seeds were washed in a weak solution of carbolic acid and then packed in moist charcoal that had been disinfected with carbolic acid. Over three months elapsed between the time of the disinfection and packing of the seed and the planting.

The above experiment was carried out by Mr. I. H. Burkhill, director of the botanical garden in Singapore.

ERRATA.

The beginning of the fourth paragraph on page 30, Volume VII, No. 1, of this REVIEW, should read: "When the seedling plants have attained a diameter of 20 to 25 millimeters 15 to 20 centimeters above ground, and are in a vigorous growing condition, they may be budded." instead of: "20 to 25 millimeters, and a height of 15 to 20 centimeters."

In the description of the atemoya, Volume VII, No. 2, line 11, it reads: "seeds 4 to 7.' It should read: "seeds 47."

The eighteenth line on page 29, Volume VII, No. 1, reads: "Hart[1] inarched cacao successfully in 1896." It should read: "Hart[2] inarched cacao successfully in 1898."

BOOK REVIEWS—JUNE.

COCONUTS THE CONSOLS OF THE EAST.

[Second edition. By H. Hamel Smith and Fred A. G. Pope.]

Reviewed by O. W. Barrett, *Chief, Division of Horticulture.*

This second edition has just appeared. As was expected, the first edition was very promptly sold out and we venture to predict that the book will run through a goodly number of editions in view of the fact that the coconut crop and all matters pertaining thereto are now occupying a very prominent place in the world's commerce.

This edition contains another very interesting foreword by Sir Wm. H. Lever, who is known throughout the world as one of the pioneer financiers who have brought about the present "boom." The concluding sentence of Sir Wm. Lever's remarks in the present edition is:

> The price at which the vegetable butter can be sold, notwithstanding the present high price of copra, is less than half the price at which natural butter can be sold.

This means for a certainty that henceforth the public is bound to rely upon coconut butter as an indispensable foodstuff.

The price of the present, much enlarged, edition is 12s. 6d.; it is published by The Tropical Life Publishing Department, 83–91 Great Tichfield Street, Oxford Street, London, W.

EVAPORATION IN THE CANE AND BEET-SUGAR FACTORIES.

[By Edward Koppescharr.]

Reviewed by C. W. Hines, *Station Superintendent.*

This very interesting book is a valuable contribution to the consideration of one of the most important factors entering into sugar-house work.

The book is divided into nine chapters and contains numerous tables and formulas valuable in sugar-house control.

Chapter II deals with a study of the properties of steam, water, and heat, and the laws governing them.

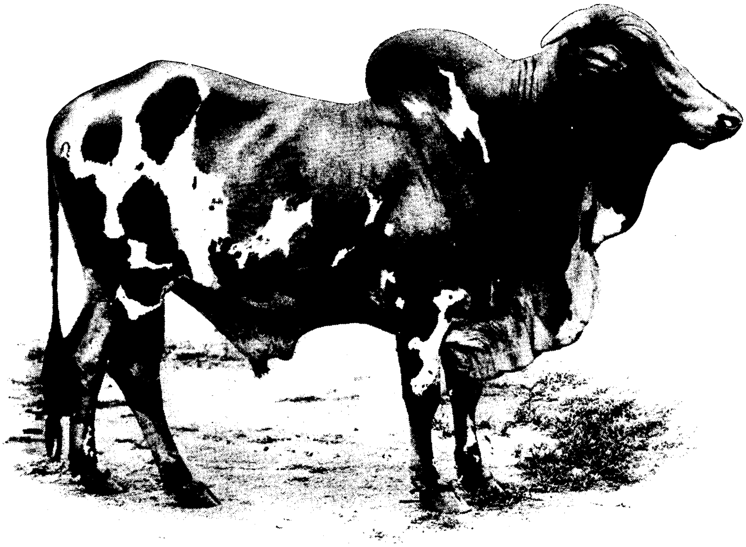
Chapter III covers the historical development of evaporation in sugar factories, and the invention of the vacuum pan.

Chapter IV treats of the multiple-effect evaporating apparatus.

Chapter VII takes up the control of the evaporating apparatus, both chemical and mechanical, coefficient of heat transmission, relation of heating surfaces, etc.

Numerous quotations are given throughout from such eminent authorities as Classen, Princen Geerlings, and others.

This book may be obtained from Norman Rodger, 2 St. Dunstan's Hall, London, England; price 7s. 6d. net.



Indian bull No. 398.

Age, 7 years; weight, 1,332 pounds; height, top of shoulder, 4 feet 9½ inches; girth, 6 feet 6 inches. Sire of Indian-native bull No. 237, and of 56 other male and female calves. Alabang stock farm.

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EDITORIAL.

THE INSULAR AGRICULTURAL SOCIETY.

By Mack Cretcher.

The campaign for the organization of farmers' coöperative societies inaugurated recently by Vice-Governor Martin is well under way. Briefly, the plan contemplates the organization of a provincial agricultural society in every province in the Islands. From this beginning it is planned that the work of organization will proceed in two directions. Delegates from the provincial societies will meet at Manila and organize an Insular agricultural society. On the other hand, the members of each provincial society will undertake the work of organizing a local society in each municipality in their province, thus giving a thorough organization of the farmers of the Islands ranging from the municipal up to the provincial society, from that organization to the Insular society, all branches of the organization being in close touch and under the direction of the Bureau of Agriculture.

Tentative constitutions for each branch of the agricultural societies have been drafted by Vice-Governor Martin, setting forth the objects of the organization as follows:

> To encourage coöperation among the farmers of the Philippine Islands and to promote the development of agriculture within the Islands.

The constitution of the proposed Insular agricultural society, which is used as a guide for the provincial and municipal societies, further says in article 4, regarding membership:

> The regular membership shall consist of all members of the subsidiary provincial societies who are actual farmers, and such other persons actively engaged in the vocation of agriculture as may be hereafter elected as regular members, and the privilege of voting in this society shall be confined exclusively to the regular members.

The intent of this action is apparent. It is to keep the entire organization, once it is effected, within the lines of purely agricultural endeavor. This feature is further covered in article 7, which reads:

> This society is not a political or a religious organization, and shall not affiliate itself with any political party or religious sect. Any demonstrations of a political or religious nature, or any discussion of these subjects,

> are strictly forbidden. In case a member shall introduce a political or religious question into any meeting of this society, or shall attempt in any way to use the society for such purposes, he shall be expelled.

Another part of the constitution, of great importance when the society is established, is article 6, as follows:

> There shall be an Insular council composed of one representative from each Provincial Agricultural Society for each of the following divisions: The Insular rice council, the Insular tobacco council, the Insular coconut council, the Insular abaca council, the Insular live-stock council, and the Insular corn council, except in provinces where above products are not produced.

The constitution likewise provides that the Director of Agriculture shall be the ex officio president of the Insular agricultural society.

So much for the proposed plans and objects of the societies. The carrying out of the plans of organization will be under the direction of the writer and a Filipino, Mr. Monico R. Mercado. These organizers are to carry the work direct to the provinces and are to see that the work is thorough and complete. No one who has given the plan a moment's serious thought is inclined to underestimate the magnitude of the task, yet it is equally true that even a casual study of coöperation among the agriculturists of other countries will convince the most skeptical of the importance of organization. The world over, agriculture is an industry of first importance. Every other great industry has an effective organization. Wherever farmers are the best organized they are the most prosperous. There is no reason to expect that coöperation would not prove of inestimable benefit to the agricultural interests of the Philippine Islands. If the farmers of the Philippines through indifference or other causes fail to profit by the example of other countries they will miss the greatest opportunity ever offered them. Statistics show that there are nearly a million small farmers in the Philippines. As yet the field of agricultural organization has not been touched. These farmers can neither cultivate nor market their crops under favorable conditions working independently and without skilled direction. They cannot hope to compete successfully with farmers of other countries who are banded together and working as a unit for mutual benefit. The remedy of coöperative organization is the one way out of the present condition. An earnest endeavor is now to be made to perfect a thoroughly efficient organization. The field for coöperative effort is stupendous. The rinderpest and locust campaigns have proven an object lesson. The introduction of more modern agricultural machinery, the establishment of sugar centrals, the instigation of a satisfactory system of rural credit, the possible installation of coöperative carabao insurance, the introduction of any improvement made by experiments in the leading agricultural industries, all depend upon a willingness on the part of the farmer to coöperate. That the work will take much time and effort, no one can deny, but it is an effort worth while. It will be approached by those in charge with enthusiasm coupled with determination and persistence. It is one of the most important movements ever undertaken for the social and material advancement of the people of the Islands and will succeed if the farmers will give it their cordial support. It is the only stable foundation upon which prosperity can be built in the Philippine Islands, and deserves not only the hearty support of the farmers, but that of all others who have the welfare of the country in view.

BUREAU OF AGRICULTURE CIRCULAR No. 31—SUGAR-CANE DISTRIBUTION.

[Circular No. 31. Manila, P. I., June 11, 1914.]

SUGAR-CANE DISTRIBUTION.

By C. W. HINES, *Station Superintendent.*

Sugar at present ranks fourth among the agricultural products of the Philippine Islands. In 1913, 176,118 hectares were cultivated to this crop, the total output being valued at ₱25,698,450.

LOCAL VARIETIES.

The greater part of the sugar cane grown in the Archipelago to-day is of the native varieties. These may be divided into two general classes, light and dark colored, and each of these subdivided into various other classes, depending upon the density of the colors, condition of growth, etc. One characteristic of these varieties is the extremely soft shell or outer tissue, which makes them easier to mill in the small plants but at the same time causes them to be more susceptible to insect pests, rodents, etc., and fails to give the cane rigidity to resist winds. As a consequence, this cane is usually in a twisted and tangled condition at harvest time and often has a diminished percentage of sucrose on account of the deterioration of that cane which happens to be in direct contact with low, wet ground. This is especially true when ultra maturity is reached.

PRODUCTION IN THE PHILIPPINES.

The average yield of sugar from the varieties of cane here in the Philippines amounts to about 2 tons per hectare. By the introduction of improved varieties, proper cultivation, and a liberal application of fertilizers the production should be greatly increased.

PRODUCTION IN OTHER COUNTRIES.

Java represents one of the most successful sugar-producing countries to-day, yet not a great many years ago her yield of sugar per hectare was but little more than that of the Philippines. By breeding up her varieties, introducing improved varieties from other countries, and by the use of improved methods and fertilizers her yields have been raised to more than 10 tons of sugar per hectare. In Hawaii the average yield per hectare on the good cane lands is about 9 tons.

VARIETIES INTRODUCED FROM OTHER COUNTRIES.

The following-described varieties have been introduced by the Bureau and are now being tested out:

Hawaiian 16.—A yellow cane, somewhat dark in portions; rind medium soft, causing the cane to be somewhat recumbent; internodes fairly short and straight. This cane yields well with suitable soil and gives a fairly rich juice.

Hawaiian 20.—Of a greenish-yellow color, turning slightly red when exposed to the sun; internodes long and the rind hard; resists insects quite well and withstands winds better than many of the other varieties. It is a very popular cane in Hawaii to-day.

Hawaiian 27.—Very large, erect, dark green or yellow stalk; somewhat resembles Lahaina, but has shorter internodes; rind firm but not quite as hard as H–20; stools well and gives a good tonnage; juice usually rich in sucrose.

Hawaiian 69.—Stalk large and yellowish green in color, with sometimes a slightly dark, mossylike appearance; rind quite soft; stools very well and has given good tonnage results. The percentage of sucrose and purity of this cane have been slightly lower than the other Hawaiian varieties.

Hawaiian 227.—An erect and tall cane; rind of a yellowish color and very hard; leaves stand up well and have a midrib which is slightly greenish but not conspicuous. Tonnage and purity results at the Bureau experiment station the past year were very satisfactory.

Hawaiian 309.—Gives a very good tonnage with soil and other conditions suitable for it; rind of a yellowish color and soft, yet considerably harder than the Negros Purple.

Lahaina.—Stalk of medium size, yellowish green in color, and somewhat recumbent on account of the extremely soft outer tissue; internodes very long. This cane was once the popular cane of Hawaii.

Louisiana striped.—Stalks usually quite large and somewhat recumbent on account of the soft outer tissue. Excellent results on tonnage and purities have been secured with this cane during the past year.

Yellow Caledonia.—Grows very large, especially where an abundant supply of water is available; stalks green or yellow, turning to red when exposed to sun; rind quite hard. While a slightly lower percentage of sucrose in juice is usually found yet the higher tonnage should compensate for this.

Formosa.—Stalk usually somewhat small and of a light-green color; rind soft, making the cane a little more susceptible to insects, especially such as the cane borer. This cane gives a very good tonnage and a juice of average sucrose content.

Demerara 95.—Has a light-red stalk with a medium-soft outer tissue; leaves narrow and very straight. Some years ago it was imported into Louisiana and became very popular there. Less encouraging results have been observed by this Bureau, but yet it may prove satisfactory for some localities here in the Philippines.

Rose bamboo.—Grows to a medium size and has a light-green color, with slightly rosy tint when exposed to the sun; because of the soft outer tissue the cane is usually somewhat recumbent. Fairly encouraging results on tonnage and purity have been observed by this Bureau.

METHOD OF DISTRIBUTION.

The Bureau of Agriculture the past year distributed cane points of improved varieties to more than 50 planters of the Philipines, many of whom report very encouraging results. It has been the custom of the Bureau to thoroughly test out each particular variety at the La Carlota experiment station before it is recommended to the planter. With the establishment of a sugar laboratory at the above-mentioned place chemical tests have been made to determine sucrose per hectare and purity of juice, and tonnage of cane, conditions of growth, etc., have also been ascertained. It is possible that conditions in the sugar regions of Luzon are so different from those of Negros that varieties which prove satisfactory in the latter may not always exactly meet conditions in the former. These facts will be determined by a wide distribution of cane varieties and through coöperation.

Therefore, a limited amount of cane points will be sent to each planter on application. The object of this distribution is to learn the adaptability of these varieties to the different localities and at the same time give the planters an opportunity to get a start with the improved varieties. These cane points are very valuable and the utmost care should be exercised in handling them. Transportation on points will be paid by applicant in all cases.

The following information should be forwarded with each request for seed cane:

Number of hectares of cane at present planted; number of hectares of land available for cane; general description of the cane now planted; tons of cane ordinarily harvested per hectare; tons of sugar ordinarily received per hectare; grade of sugar ordinarily produced; general composition of soil (loam, clay, sandy, etc.); whether irrigation water is available; whether irrigation has been tried on sugar cane; general method of preparing the land and planting the cane; method used in furrowing out the rows; distance between the rows; number of times and manner of cultivating during the growing season; general description of the milling plant used in manufacturing sugar; capacity of mill per day; and varieties of cane desired from this Bureau.

Each application will be placed on file and the points will be sent out between the 1st of October and the 1st of December.

INDIAN CATTLE IN THE PHILIPPINES.

By C. W. EDWARDS, *Chief, Division of Animal Husbandry.*

The Philippine Archipelago with its extensive pasture areas, abundant water supply, and tropical climate is principally a live-stock country, and of the various branches of the animal industry the production of cattle, owing to their comparatively greater economic value, is of first importance. However, a combination of circumstances has brought about a condition in which there is a woeful dearth of both meat and work stock and measures giving promise of any degree of amelioration of this condition are worthy of most careful consideration at this time.

In this connection two methods naturally present themselves as a means toward effecting an increase in the present number of animals—importation and the breeding of the present indigenous stock. The situation may perhaps be relieved to a certain extent through importation of animals for work purposes and for the establishment of breeding herds, but under present conditions and restrictions the process would only improve conditions in a small degree. Even if all restrictions regarding importations were removed there is no reason to doubt but that the factor which has caused the depletion in numbers, namely, disease, would be augmented and thus defeat the ultimate end. The means of relief which most concerns the people as a whole is the increase in numbers and value of their local stock, and to accomplish this the causes now regarding normal progress—disease and lack of improved blood—must be taken into consideration. A considerable amount has been spent in an effort to raise pure-bred European and American cattle and their crosses with the native stock, but except in a few special cases the attempt to raise the pure-breds has failed, and the crosses, while showing good conformation and size, were more susceptible to disease. In fact, this has been the general experience throughout the Tropics under natural range conditions. Considerable numbers of cattle have been introduced from tropical China and Indo-China and, although well adapted in many respects to the country, these animals, particularly the former, are susceptible to rinderpest and are not in general as great an improvement over the native cattle as regards size, conformation, and prepotency as should be the case with breeds used for upgrading a native stock.

Of recent years, following the methods pursued in some of the other Oriental countries, experiments have been conducted with the Indian cattle both as pure breeds and as upgrading mediums, and the degree of success attending this work has been such as to warrant steps being taken without delay for development upon a much larger scale.

Lieut. Col. W. D. Gunn, formerly superintendent of the civil veterinary department, Madras, gives the following as the principal breeds of Zebu (*Bos indicus*) cattle:

1. Mysore breed (A) Amrat Mahal.
2. Mahadeswarabetta or Alumbadi breed.
3. Ongole or Nellore breed.
4. Kangayan breed.
5. Pulikolum, Jellicut breed.
6. The Kappliyan breed.
7. Gumsur breed.

These cattle are characterized by the prominent hump, excessive dewlap, drooping ears, long body, long narrow head, and elliptical eyes. Of the breeds mentioned, Colonel Gunn states that the Ongoles and Mysores are the most important; the former are particularly noted for their size and suitability for steady heavy-draft purposes and the latter for their agility, high spirit, extremely hard feet, and aptitude for road work.

The Ongole or Nellore is the only breed with which any definite breeding experiments have been carried on in this country. Cattle of this type are bred in greatest numbers in the Guntur district, Madras presidency. They are silvery gray with darker shadings over front and hind quarters, pure white, and occasionally red and white in color. These breeds have been imported into Brazil, Argentina, Java, and Africa in considerable numbers for crossing upon indigenous stock, and a few have been imported into the United States, particularly into Texas.

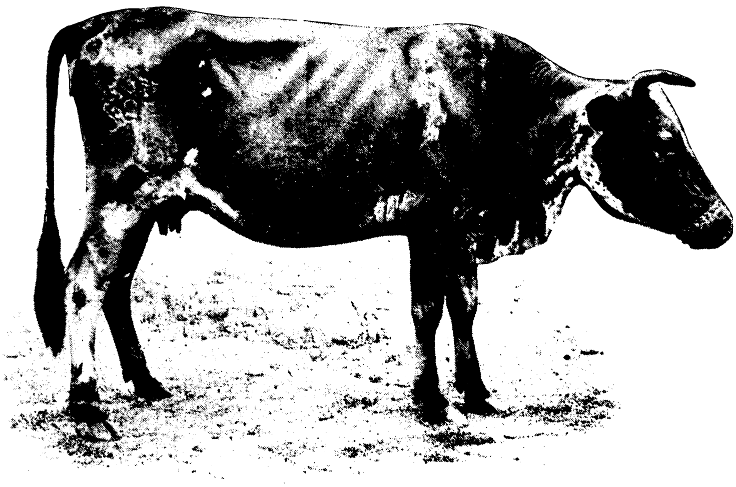
The first local importation of these animals made by the Bureau of Agriculture arrived May, 1909, at which time a shipment of 10 Nellore cows, 2 bulls, and 1 calf were brought in. Previous to this time a few pure-bred animals and grades of this breed had been imported by local dealers.

A portion of the above-mentioned shipment was sent to the La Carlota station, Occidental Negros Province, and the remainder to the Trinidad stock farm, Benguet. The latter herd was afterwards removed from Trinidad as it was found that they were not adapted to the climate of that vicinity. The following year approximately 40 head more of these animals were purchased from a local importer, a few of which were sent to the subprovince of Bukidnon and the remainder added to the herds at La Carlota and Alabang.

The results obtained from the various trials conducted with these cattle have been most excellent and a sufficient amount of work has been done along this line to bring out certain characteristics of the breed which commend them particularly for this country. First among these characters should be mentioned their high resistence or apparent nearly complete immunity to rinderpest, also their immunity to tick fever and the fact that they are not troubled by insect pests to nearly the same degree as are the native animals. In all sections excepting those of high altitudes where the temperature is comparatively low during the rainy season, these animals have exhibited remarkable rustling qualities, particularly during the dry season. At the Alabang stock farm the soil of the upland pasture areas is very thin and is a poor conserver of moisture so that at times the pastures become very sparse. During the latter part of the dry seasons of the past two years although not a spear of green feed was in evidence in the Indian-cattle pastures, these animals, without being fed a particle of forage, kept in good range condition throughout the season. On the Island of Palawan where the Bureau of Prisons maintains a large-sized herd of pure breds and grades, during a portion of the past dry season the pastures were very poor, the cattle subsisting at times principally on the leaves of shrubs. During this period a number of the native calves succumbed to starvation, but the records of the Bureau show that no Indian cattle or grades were lost from this cause, indicating the comparative rustling qualities of these animals and the native stock.

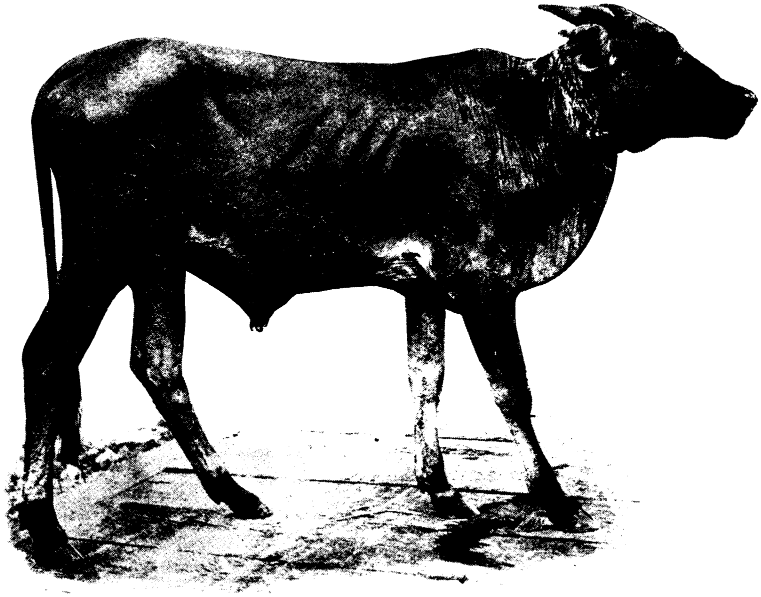
The Ongoles are noted as work animals and a number of them have been used for this purpose at the Bureau stations where, generally speaking, they have given good success particularly for road and light field work.

Perhaps the greatest value of this breed to the Philippine Islands lies in their use as a cross or factor for upgrading native stock and in this they promise to be very satisfactory. These crosses are highly resistant to rinderpest, are a great improvement in size and conformation over the native dams, and, in fact, exhibit to a surprising degree most of the desirable charac-



(*a*) Native cow No. A. 302.

Age, 9 years; weight, 572 pounds; height, top of shoulder, 3 feet 8 inches; girth, 5 feet 2 inches. Dam of Indian-native bull No. 237. Alabang stock farm.



(*b*) Indian-native bull No. 237.

Age, 1 year 6 months; weight, 370 pounds; height, 3 feet 7⅝ inches; girth 4 feet 4 inches. Note height as compared with that of dam. Alabang stock farm.

teristics of the Indian. Indian bulls have been stationed in a number of the provinces in connection with the public-breeding work; in each case the bull has been turned out with the local native herds, no extra feed or attention being given, and the results have been most pleasing.

In many respects, the Indian cattle are not to be compared with our improved European and American breeds, but they are possessed of certain characteristics which under existing conditions make them far better adapted to this country. As regards conformation, they are too upstanding and rangy, often inclined to be slab sided; the grades out of Chinese and native dams, however, seem to be more compact in conformation. They also often have a tendency to be vicious, being difficult to handle or to keep confined; especially is this true where they have been allowed free range and have not been accustomed to handling.

As regards their suitability as work animals they seem excellently well adapted for cart and certain classes of field labor; in fact, a number of our station superintendents have requested that all of the work cattle be replaced by the Ongoles as they state so much more can be accomplished in a given time than with other classes of work cattle. However, in some instances, these animals have exhibited a tendency when under work to be sulky, especially where the labor is such that the draft is comparatively unsteady. When we consider the heavy work that they perform throughout their native country it would seem that this characteristic is largely due to a difference in the method of handling rather than to a fault of the breed.

With respect to the quality of the meat of these animals, it is somewhat darker in color than that of the native or the occidental breeds; it is of fairly good texture, however, and judging from the experience of local dealers who have imported a few pure breds and grades for slaughter, there is no objection on the part of the public to the meat in this respect.

Considering the large public interest and demand for these animals at present and the fact that their importation in large numbers for crosses upon the native stock would seem to be a definite step toward the solution of the rinderpest problem, it certainly appears advisable to set aside funds for the importation of these animals in appreciable numbers for increasing the herds of the Bureau stations and supplying sires for placing in the various provinces in connection with the public-breeding work being carried on by the Bureau.

SUGAR MANUFACTURE.

By C. W. HINES, *Station Superintendent.*

[Continued from the June number.]

The sirup from the pan storage tanks is now boiled until the proper concentration is reached or until the desired grain is formed. This will depend very much upon the condition of the material, its purity, etc., and also upon the individual desires of the consumers. There are found in the United States all grades of sugars, ranging from the ordinary powdered or dust sugar of commerce to the confectioners' grain, which is usually quite large. Of course, the powdered sugars are made by crushing the larger grain in a machine for that purpose, but the very fine table sugar is made directly in the pan.

In some parts of Europe it is common to find a very large crystal; indeed, the larger the crystal the higher is the price paid for the sugars. Further on in this article a discussion will be made as to how those different-sized crystals are formed.

This Bureau has a very complete collection of sugars showing the different sizes of grain, varieties of sugars, and those made from different sources, including cane, beet, palm, maple tree, sugar of milk, etc.; also a collection of refined sugars made by the most important processes of refining.

THE VACUUM PAN.

In modern sugarhouse practice the final concentration is always done under vacuum. The importance of concentrating the thin juice under vacuum was pointed out in a previous article, but this does not have nearly as great importance as concentrating the heavy massecuite under vacuum, since the heavier the liquor becomes the higher will be the boiling point, and consequently the greater will be the danger of inversion and carmelization.

The following table by Classen and Hermann, taken from "Evaporation in the Cane and Beet Sugar Factories" by Koppeachaar, will serve to show the boiling point of different concentrations of sugar (sucrose) solutions at a pressure of 760:

Percentage of sugar (sucrose) by weight.	Percentage of water.	Temperature.
		°C.
----------	100	100
10	90	100.1
20	80	100.3
30	70	100.6
40	60	101.05
50	50	101.8
60	40	103
70	30	105.1
75	25	107
80	20	109.4
85	15	113
90	10	119.6
92	8	123

The historical development of the vacuum pan is similar to that of the effects; in fact, this was a forerunner of the effects and it was only during the past year that the centennial of the vacuum pan was celebrated. Mr. Howard, of Sheffield, England, took out his first two patents on the vacuum pan in the years 1812 and 1813. In this case the juice was heated by introducing steam into the double bottom and a special method was provided for drawing off the condensed water thus formed. The importance of his invention was so thoroughly recognized in those early days that in 1816 his royalties reached ₱1,100,000.

When it is realized that the manufacturer who is still making sugar by the open-kettle process is really one hundred years behind the times, no one should be surprised to find that this manufacturer is approaching a stage when he will have no market. This is the condition at present confronting the majority of the Philippine sugar manufacturers who persist in using antiquated methods.

The ordinary vacuum pans to-day are large cylindrical vessels set vertically, the top of which consists of a conical-shaped dome containing a large pipe through which the vapors pass to the condenser. Catchalls to trap any entrained liquor are placed in this pipe between the pan and condenser.

The three most common styles of vacuum pans found on the market to-day are the Express, Calandria, and the ordinary coil type.

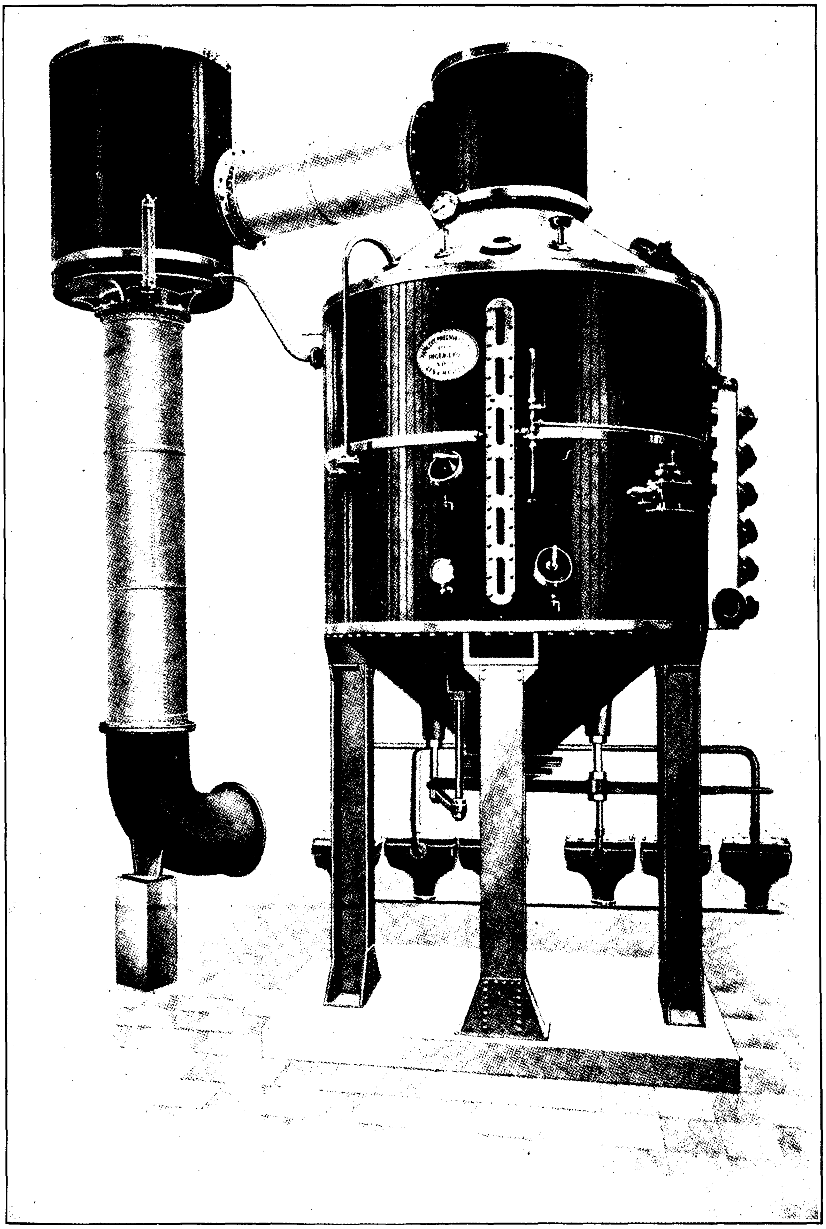
The Express vacuum pan.—This style of vacuum pan contains a belt in which tubes are set parallel with each other. These tubes are usually about 40 centimeters long, but may vary in length, depending upon the particular design of the pan. This belt is so arranged that it sets at about 30° from the horizontal. There are usually two of these belts for each pan.

The Calandria, or vertical-tube pan.—The main portion of this pan is similar in design to the standard vertical effect. Here are a series of tubes vertically arranged. These tubes are quite large, usually about 4 inches (10 centimeters) in diameter. This is for the purpose of facilitating the circulation of the heavy massecuite. Beneath this belt of parallel tubes will usually be found a series of steam coils, which are used mainly for graining when only a small amount of material is required for that purpose, or whenever the boiling material happens to be low.

Coil type of vacuum pan.—The heating surface of these pans consists of a number of helical copper coils, usually from three to six, arranged one above the other. Each of these tubes is provided with its own individual valve and thus the operator is able to control his boiling by the amount of steam admitted to each coil. One advantage of this type is that on the starting or whenever the level of the liquor happens to be low, the steam in the upper coils may be cut off and thus the darkening of the solution by caramelization prevented.

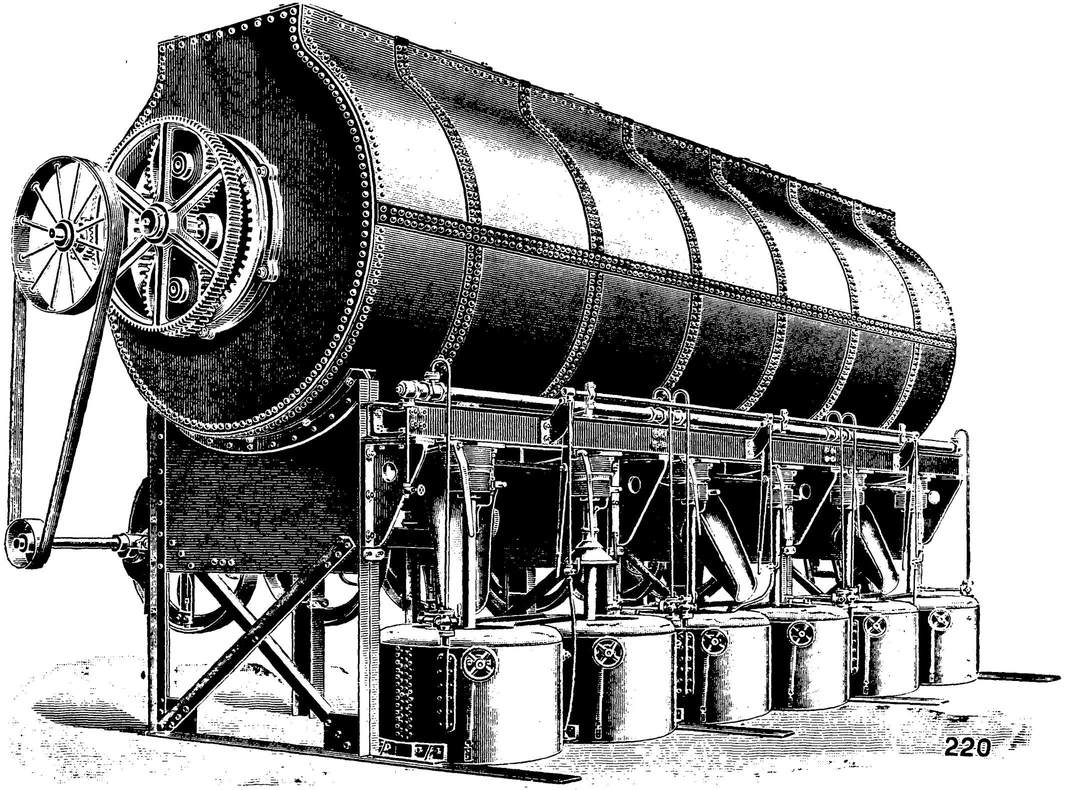
Entrainment.—A certain amount of liquor passes upwards with the vapors here as well as in the effects; in fact, whenever a very high vacuum is maintained the velocity of the vapors becomes greater and consequently offers better opportunity to carry with them particles of suspended matter. For this reason tests should be made on the condenser water here as well as on those from the effects. These tests are made in the same manner described for condenser waters from the effects. It is well also to test the water of condensed steam from the steam traps occasionally, especially after the vacuum has been "broken," since the heavy massecuite is liable to break down the copper tubes.

Condensers.—The condensers for this work are usually of the jet type, the same as those described before. Where large units are installed, each pan will have its own separate condenser. Sometimes, however, where there are two pans set near each other, they are connected with the same condenser and occasionally we find both effects and pans connected in this manner. The writer visited one factory here in the Philippines where two small pans and the last member of a tripple effect were thus arranged. This, of course, is a great saving in installation and an economy of steam for driving vacuum pumps as well, but it is doubtful whether as satisfactory results

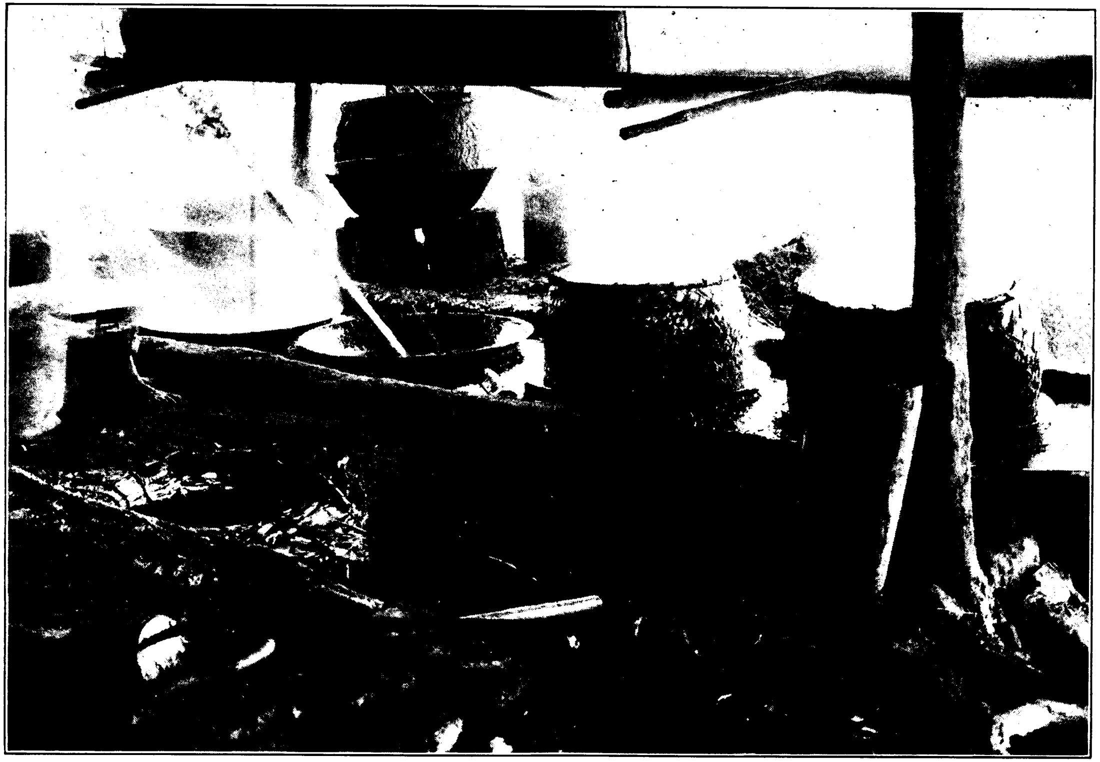


Modern vacuum pan and condenser used in producing sugar crystals.

PLATE IV.



Modern "Weston" centrifugal machines and massecuite mixer used in sugar work.



Old method of boiling sugars.

will ordinarily be obtained. Our experience in one sugar house arranged in this manner proved that the condenser and pump did not have quite sufficient capacity when both the effects and pan were working, consequently one or the other had to be shut down during part of the time.

Sugar boiling.—The purpose of boiling the juice is to induce crystallization. This will take place only after a certain concentration is reached for each particular purity. The higher this purity the easier will the sucrose crystallize out and the lower the density will need to be. One of our methods used in general chemistry for purifying certain substances is by crystallization. Some substances will crystallize much more readily than others. Indeed some crystallizable substances are very difficult to start crystallizing, and we resort to certain means of starting the material to crystallize, such as by introducing seed crystals of the same material or by briskly rubbing the side of the container. There is always a stage of supersaturation reached before the material will begin to deposit in the form of crystals. This supersaturation stage is something that is carefully watched by the man in charge of the sugar boiling. Classen states:

> For the formation of grain in the vacuum pan it is necessary that the sirup be supersaturated; as soon as supersaturation has reached a certain degree then crystals begin to separate.

The art of sugar boiling is one which requires a great deal of skill and attention in order to accomplish the very best results. It is true that ordinary workmen can boil sirup and even produce a grain; the pan alone would do that if provided with juice and the steam turned on. It is a law of nature that crystallization must take place when a certain concentration of a juice containing the proper per cent of sucrose is reached, and indeed this crystallization can not be prevented without a change in the composition of the substance. The problem for the sugar manufacturer is how he may produce the most economical results and give the maximum drop in purity between the massecuite and the molasses.

The writer has had occasion during the past campaign to visit a number of factories making centrifugal sugar throughout the Islands and has taken a very deep interest in the boiling-house work. He is glad to state that some of the most efficient sugar boilers to be found anywhere have been observed among several of the factories making centrifugal sugars here in these Islands; but as a matter of fact too little attention is given to this very important part of the work by many of the smaller factories and consequently an enormous loss is incurred through a desire to save in salaries by factories the least able to afford it. In several instances native boys supervise this work after an experience of one or two weeks on the pan floor, with one in charge having but little greater knowledge than the boys. The manager of one of these factories took pride in explaining that he could run his factory under a minimum of boiling-house expense, since his head man in this work was costing him but ₱1 a day. Aside from the unnecessary loss of sucrose in high-purity molasses, which was run into the river, there was occasioned from time to time the shutting down of the crushing plant, caused by the inexperienced operator using an extra amount of steam at the pan. This, of course, caused another great loss to the factory, which could very readily have been avoided by an efficient man.

Boiling to a grain.—There are various methods of carrying out this part of the operation, but in general the underlying principles are the same. Each experienced operator usually has what he considers trade secrets in the work which are peculiar to his own methods of working and can only be acquired through extensive practice and careful observation.

One method quite often practiced is to fill the pan to the desired height, usually about half full of sirup, and then turn on the steam. The vacuum is maintained as high as possible, usually from 25 to 27 inches (65 to 70 millimeters) of mercury, and the concentration allowed to increase until the graining point is nearly reached. The operator will now decide whether this volume of thick juice will give him a sufficient number of crystals to build on; should he decide that it will not give enough, then he will open the sirup valve and continue to concentrate until the volume becomes satisfactory. He will then proceed to "strike grain," and observe carefully when the required amount of grain is formed. This point being reached, he will stop the formation of new grain by lowering the vacuum which causes the temperature to rise, or by letting in more juice, etc. From now on the process is one of building on to the grain already formed with the sucrose in the sirup and the reduction of the purity of the molasses until the final massecuite is reached. During this part of the process continued vigilance is required in order to keep the concentration right for the maximum rate of crystal building and at the same time prevent the formation of "false grain" or very fine new grain, which goes through the perforations of the centrifugals and causes a loss of sucrose in the molasses.

The economy brought about at this stage of the work by employing inefficient workmen is only apparent, and often causes a loss in the boiling of one single strike which would go a great way in paying the monthly salary of a good man.

As stated before, the art of sugar boiling is one that can only be acquired by careful and systematic work and, after once thoroughly learned, only the most careful and conscientious work will yield results.

While the method used to-day in determining the graining point, and especially the density after the liquid has become quite heavy, may appear to be somewhat crude and unscientific, yet an experienced man can usually tell with great precision just what condition his material is in. There is an instrument, however, called the "brasmoscope," which aims at more scientific principles, but this apparatus has not been generally introduced for obvious reasons.

The brasmoscope.—This consists essentially of an accurate barometer and an accurate thermometer. The principle upon which it works is as follows: Since water under atmospheric pressure boils at 100° C., at any intervening pressure between zero and atmospheric it will have a definite boiling point corresponding to that particular pressure. Now, upon the addition of a sucrose solution, the boiling point will be correspondingly higher and always nearly the same for that particular concentration. A 75 per cent sucrose solution will require a temperature 7° C. higher than that of pure water before ebullition occurs in it. Working upon this principle, Mr. Curin constructed this apparatus and the necessary tables to show the densities resulting therefrom. It is obvious that this principle could be used only for molasses and sirups free from grain. Should grain be present it would only show the density of the mother liquor which contains the grain. Again, should there be a great amount of grain there will be some variance of temperature due to the poor circulation of the massecuite and thus inaccurate results will be obtained. The following table from Princen Geerlings' "Cane Sugar and its Manufacture" will serve to show the average composition of cane sirups at the graining point:

No.	Brix.	Polarization.	Reducing sugars.	Water.	Quotient of purity.	Glucose ratio.	Sucrose on 100 water.
1	79.21	71.70	3.34	21.59	90.52	4.66	332.1
2	80.32	72.23	3.63	20.88	89.93	5.07	345.9
3	79.73	69.00	5.16	21.27	89.65	6.25	325.8
4	77.65	70.81	3.97	23.65	89.17	5.57	299.4
5	89.43	71.11	3.91	22.67	88.68	5.60	326.9
6	80.62	71.55	3.99	20.08	88.62	5.58	356.3
7	81.72	71.87	5.04	19.58	87.95	7.01	367.1
8	78.59	68.95	4.52	22.61	87.45	7.14	304.9
9	83.11	72.48	3.40	17.99	87.21	4.7	402.9
10	79.26	69.00	5.16	21.74	87.06	7.48	317.4
11	78.47	67.49	4.82	22.73	87.04	7.14	297.0
12	83.50	72.52	4.18	17.40	86.85	5.76	417.8
13	78.51	68.15	5.59	22.39	86.81	8.2	304.4
14	79.55	67.54	5.64	21.45	84.89	8.35	314.9
15	79.75	66.49	6.71	21.49	83.37	10.09	309.4
16	75.95	63.14	7.60	25.19	83.13	12.0	250.6
17	79.10	65.67	3.85	21.60	83.02	5.86	304.0
18	81.05	66.77	3.71	19.75	82.38	5.55	338.1
19	84.73	69.52	4.97	17.67	82.05	7.15	393.4
20	85.56	70.19	4.70	15.54	82.03	6.7	451.7
21	81.60	66.9	8.26	19.43	82.00	12.3	344.3
22	78.74	64.13	4.11	22.46	81.44	6.41	285.5
23	83.83	68.24	5.43	19.54	81.37	8.0	354.6
24	80.36	65.0	7.78	20.75	80.90	12.0	313.2
25	82.08	66.3	7.81	18.17	80.79	11.78	364.9
26	85.29	68.48	5.34	17.02	80.29	7.78	402.3
27	80.28	64.34	8.08	20.89	80.14	12.56	308.9
28	83.20	66.40	8.26	18.07	80.00	12.4	367.4

Princen Geerlings also states:

> In this table the sucrose content is assumed to be identical with the polarization, on account of the relatively low percentage of reducing sugar. Further, it is assumed that the solubility of sucrose in the water of the sirup is the same as pure water and that the sugar is grained at 45° C. According to Herzfield's table the solubility of sucrose in water at 45° C. is 71.32 parts of sucrose in 26.6 parts of water, or 241.7 parts of sucrose in 100 parts of water. When calculating from these values the amount of sucrose actually dissolved in the sirup we can find by differences the amount of sucrose present in a supersaturated form, and which could crystallize out at the given temperature if the sirup were strongly agitated.

It will be noted that the purity of a sugar solution determines to a great extent the amount of sugar crystallizing out and the rate at which these crystals are formed. The nature of the impurities present also has a great deal to do with it. The impurities found in cane juice are mainly of an organic nature and consequently give little trouble in extracting the maximum amount of sugar out by direct crystallization, but where the juice is heavily laden with salts, as in beet-sugar work, this is much more difficult. It is therefore possible under practical sugarhouse conditions to reduce the apparent purity in cane-sugar work to from 28 to 35 per cent, while in beet-sugar work it is ordinarily not practical to reduce the purity lower than 55 or 60 per cent by direct crystallization. This does not, however, imply that all of the sugar left in the molasses will be lost or disposed of as a by-product, for we have to-day what is known as the "Steffens process," whereby practically all of the sucrose will be recovered. In this process the sugar is made to combine with lime under certain conditions and form calcium saccharate which will be filtered off and decomposed with carbon dioxide, forming calcium carbonate or lime stone and sucrose. This calcium carbonate is then filtered off and the sucrose crystallized out of the comparatively pure solution.

The Steffens process is not used in cane-sugar factories on account of the high glucose content of cane juices, but a modification of it is used in a special process recently patented by E. E. Battelle, of Hawaii.

As stated before, the boiling of material of high purity to grain is done in the vacuum pan. This is not, however, the case when boiling the lower-grade products, such as molasses, where the purity has been greatly reduced by having its sugar removed by previous crystallization. Sometimes these lower-grade products are used in building on crystals formed from sirups, but usually it is necessary to boil to "string proof" and place this material in tanks or crystallize until the proper grain forms.

Crystallization in motion.—The apparatus for this work is made in two general types, the open and the closed crystallizers. Both contain stirring apparatus to keep the massecuite in motion during crystallization so that the sucrose still in solution will be brought into intimate contact with the crystals. This has the effect of building larger grain instead of starting new or false grain.

The closed-type of crystallizers are usually so arranged that vacuum may be produced in them, if desired, as this often hastens the deposit of sucrose. They are also sometimes arranged for discharging by compressed air.

It is often desirable to heat the very viscous heavy mass in the crystallizers in order to cause the material to flow more freely when being emptied or to spin better in the centrifugals. Also it sometimes happens that the material should be cooled quickly in order to induce crystallization to start sooner. For these conveniences closed types of crystallizers are surrounded by a jacket into which hot or cold water may be admitted, as required.

Sometimes a crystallizing room is provided with small cars which receive this massecuite and are then rolled to the large room, where they remain for some time to await crystallization. While crystallizers form a great improvement over this system, yet it is well to use the cars where they are already installed.

In addition to the motion crystallizers and massecuite cars mentioned above, sufficient magma storage tanks should be provided to receive the low grade products boiled to string proof which have a purity below a certain point. Usually the molasses from the crystallizers and tank-car massecuites can be well boiled again and made to produce a low-grade sugar which may be melted up and grained in the vacuum pan alone or with first sirup, and thus be made into a good grade of sugar.

One source of great loss to the majority of the factories here in the Philippines is in the high grade of molasses discarded on account of insufficient apparatus and proper attention to this part of the work. The writer has analyzed molasses from a number of factories which was being discarded into the river or sold for little or nothing, and found that the average apparent purity was 50 per cent, while some were much higher than this. Now, these molasses, if properly treated, should be reduced to at least 35 per cent purity. Let us calculate the saving thereby on a ton of the molasses.

The total solids of these molasses was usually about 82 per cent. Then a ton of this material will contain 820 kilos dry matter and 50 per cent of this, or 410 kilos, will be the sucrose left in the molasses. Should this purity have been reduced to 35 per cent there would then have been left 287 kilos sucrose. The difference is equal to 128 kilos of 96° beet sugar.

In Mexico, Cuba, and many other countries they have alcohol factories in connection with the sugar factories, where this molasses is immediately converted into alcohol.

Mr. Noel Deerr, the eminent authority on sugar manufacture, was called to inspect conditions in several Hawaiian factories the past year where a lower recovery was attained than in similar near-by factories, and among other losses reported was the high purity of the waste molasses.[1]

False grain.—The principle of sugar boiling consists of forming the required number of grains and then carefully guarding the conditions so that no false grain will form. Since time as well as concentration is necessary for the proper building of grain, if the concentration should go on so rapidly that the state of supersaturation should go very high there will be a new crop of grain formed which will result in giving a lower yield of sugar, a higher purity of molasses, and a great deal of trouble in the subsequent spinning of the massecuite in the centrifugals.

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[1] Hawaiian Planters' Record, September, 1913, Vol. IX.

Sometimes, however, a cut strike is used, i. e., one in which a part has been removed and run through the centrifugals while the remaining part is used in building on in another strike. This, of course, gives a larger grain than is ordinarily gotten by one boiling. Another method often practiced where a large grain is desired is by introducing grain into the pan from a previous strike which will be used in building on until the desired size of grain is reached.

Since a great deal of time in crystallization is required to make a large grain it is not profitable to follow this practice in raw-sugar manufacture, nor is it ordinarily profitable in the manufacture of high-grade sugars unless there is a special market for them.

As stated before the size of grain can be absolutely regulated to suit the particular desires of the managers if the man at the boiling plant does his work properly.

Centrifugaling the massecuite.—After the boiling of the sugar is finished the water to the condenser is shut off, the vacuum pump stopped, and vacuum broken, i. e., air let into the pan from a valve for that purpose. The large gate at the bottom of the pan is then opened and the massecuite allowed to flow into the mixer. This is a large tank or receptacle with a shaft and iron stirring apparatus which is kept constantly in motion until all of the massecuite is used up by the centrifugals. The purpose of this stirring is to keep the massecuite constantly agitated, since it is very viscous any way, and that near the top would become quite hard by the time all of the material is finished.

If the massecuite has been boiled properly this part of the work should be quite simple unless in case of abnormal conditions of the original juice or very low purities from other sources there is present certain gummy materials which make the work more difficult. The writer once observed the working process of material having very low purities due partly to the presence of dextran caused by the organism *Leuconostic mesenteriordis* after a series of severe freezes in the cane region of Louisiana, where a good deal of trouble was had, not only in the boiling of this material but in the centrifugal work as well.

Material with a uniform grain will usually spin the best in the machines, in fact a great quantity of fine grain mixed with the larger ones not only causes a higher loss of sucrose in the molasses but slower working of the centrifugals as well.

The question is sometimes asked whether it would not be practical to install a mixer and centrifugal plant for the purpose of spinning the open-kettle sugars and thus be able to receive the benefit in price of that class of sugars. On account of the extremely small grain and the gummy nature of the material this would obviously be entirely impractical. Indeed, one place here in the Philippines has been observed where this has been attempted, but the whole affair was cast aside and ordinary No. 4 sugar turned out.

After the molasses is thrown from the crystals it is sometimes desirable to raise the purity of the final sugar still more, in which case a certain amount of water or steam is sprayed into the compact crystals while still in motion. In every event when this method is practiced there should be a separate trough to receive the molasses and the waste from the sugars, since the latter will have a much higher purity than the former. This may usually be sent back with the original sirup and used in starting grain again.

The molasses from the first strike will usually be used in building grain again in the manner described for the first sugar, except that it will usually be advisable to start the grain with high-grade sirup or use seed grain as is practiced at several places here in the Philippines.

The molasses from the second strike will most generally be boiled to a string proof or sometimes to grain for the tank cars or crystallizers. Since the purity of this material has now dropped a considerable amount, due to the previous crystallization, it may take some time to form proper crystals. This material is then spun in the usual manner and a lower grade of sugar results. It is not ordinarily practical to attempt to bring this sugar up to 96° test though this is sometimes done by a good deal of washing or by mixing it in the proper proportion with higher-grade sugars.

The molasses from the tank cars and crystallizers will have an apparent purity of from 48 to 56, depending upon the previous method of handling. In any event it will be well to boil this to string proof and deposit in magma tanks, where they are available, and leave to crystallize until the beginning of the next campaign. Since time is the factor here in crystal growth the longer they are left to grow the lower will be the purity of the resulting molasses and the higher the recovery of sugar. This word *recovery* means pesos to the manufacturer and is often the deciding factor between success and failure in factory work.

CURRENT NOTES—JULY.

NOTES BY O. W. BARRETT, Chief Division of Horticulture.

[From the Daily Consular and Trade Reports of the United States Department of Commerce.]

FREE-SEED DISTRIBUTION IN THE UNITED STATES AND THE PHILIPPINE ISLANDS.

The United States Department of Agriculture sends out gratis, in rather generous package collections, some 600 tons of vegetable seeds and about 25 tons of flower seeds. Taking the Philippine population as about one-twelfth that of the United States, the per capita amount of free-seed distribution in the United States is approximately fifty times the amount required in the free-seed office of the Bureau of Agriculture.

CHINESE PEANUT CROP.

A little-known and seldom-mentioned feature of the oil industry is the Chinese peanut crop. The output of the Swatow district is something over 1,000 tons of nuts and about 1,500 tons of peanut oil.

BANANA CONSUMPTION IN THE UNITED STATES.

The United States is now consuming about 6 billion individual banana fruits per annum. This means something like 60 fruits per capita; but when it is remembered that about one-half of the population practically never eat this fruit and only about one-fourth of the people regard it as a standard article of diet, we realize the comparatively large amount of money annually spent by a few million people for the 200 to 300 or more fruits per capita consumed by the limited banana-eating class. The present order of importance of the world's banana-producing countries is:

Jamaica (17 million bunches).
Costa Rica (10 million bunches).
Honduras (6½ million bunches).
Colombia (5 million bunches).
Panama.
Canary Islands.
Cuba.
Nicaragua.
Guatemala.
Mexico.
British Honduras.
Santo Domingo.
Dutch Guiana.

The average market price of banana bunches shipped to the United States from tropical America is about 55 to 60 centavos. At the rather low yield of 400 to 500 bunches per hectare, this gives a gross income of about ₱225 to ₱275 per hectare. In the wholesale trade a standard market bunch of bananas has 9 "hands" (Tagalog "pilings"), a bunch containing 8 hands counts as three-fourths, and one of 7 hands as only one-half, while it takes 4 six-hand bunches to make a "count." Bunches containing 12 to 15 hands are not uncommon in Central America but are seldom seen at present in the Philippines. A bunch containing 22 hands has been recorded in Panama, and the writer once heard of a 25-hand bunch of the famous Johnson banana of Santo Domingo.

AGRICULTURE IN GERMAN EAST AFRICA.

Agriculture in German East Africa is developing rapidly. The rubber industry, fostered to a great extent by the colonial government, is quite successful, although it appears some mistakes were made with Ceará at the beginning of the "boom." Plantation rubber in the colony is now well above 2 million pesos in export value per annum, while the wild rubber which three years ago amounted to considerably over a million pesos has now dwindled to a comparatively small amount. Sisal, imported from tropical America, succeeds considerably better in this colony than in its home country. The plants which require five to ten years for full maturity in the New World reach full development in less than four years. In Zambesia, a few hundred miles south of German East Africa, the writer has inspected sisal plantations, probably unexcelled anywhere in the world, wherein the plants were beginning to pole in about forty-five months from transplanting and were carrying leaves 2 to 2½ meters long throughout the plantation.

TUBA FROM COCONUTS IN THE MADRAS PRESIDENCY.

In the Madras presidency of India coconuts are tapped to a considerable extent for tuba or, as it is called, tári (in English slang, known as "toddy"). About 140 liters is considered the average yield of tuba per tree per year. Most of this sap is allowed to ferment for distillation. Sugar also is made from coconut tuba, but the greater part of the palm sugar of India is produced by other species such as the wild date.

COPRA IN WEST AFRICA.

The Philippine Islands supply something like one-fourth of the copra of the world—a matter of some 30 to 50 million pesos (normal crop). The West African provinces of northern and southern Nigeria alone are exporting well over 40 million pesos worth of palm kernels and palm oil from the oil palm (*Eleis guineensis*) which long has been and probably long will be the greatest rival of the coconut. Besides this tremendous export of oil-palm products, the Nigeria provinces are turning out about half a million pesos worth of shea nuts and shea butter per annum. The home consumption of shea butter which the 18 million natives depend upon for cooking purposes, is a very large item but accurate statistics are of course wanting for this trade.

RUBBER IN THE ORIENT.

It is estimated that there is now under rubber cultivation in the East something over 375,000 hectares (950,000 acres), though a "part will no doubt revert to jungle;" only a moderate proportion of the estimated 110 million trees on plantations in the East have been tapped. The total plantation-grown rubber is estimated as somewhere around 35,000 tons. Of this amount Ceylon and India are producing about one-fourth. Brazil continues to supply some 40,000 tons of wild rubber.

NOTES BY P. J. WESTER, Horticulturist in Charge of Lamao Experiment Station.

THE FOOD VALUE OF CACAO.

When the Spaniards discovered Mexico they found that chocolate was the most esteemed beverage of the native inhabitants, and Linné aptly named the plant *Theobroma.* According to an article in the Tropical Agriculturist, Richelieu owed his health and activity of his later years to the use of chocolate. The same publication states that about the middle of the nineteenth century Mitscharlich made an examination of the composition of cacao and the chief physiological actions of its constituents, which led him to the opinion that cacao was preferable to coffee and tea as a beverage because of its food value, while the two other beverages are merely stimulants. We quote the following verbatim:

> Harnack has demonstrated scientifically the complete harmlessness of cacao to the stomach, heart, and nerves, so that it may be continually drunk by children as well as by weak and sick persons without the least

damage. The albumen content of ordinary cacao with a medium percentage of cacao butter is about 25 per cent, which is equal to that of medium fat beef, while the amount of easily digested cacao fat is five times that of beef. Eggs contain about 12 per cent of albumen and fat, about half as much as is contained in cacao, which moreover, contains a valuable ingredient in calcium phosphates.

The rise of popularity of cacao as a beverage in modern times took place in Europe, and it was there extensively used before it was employed to any appreciable extent in the United States. However, the use of cocoa and chocolate in that country has increased enormously during the last quarter of a century, or from a consumption of 8,150,000 kilograms in 1890 to over 63,400,000 kilograms in 1913. While coffee, tea, and maté will always hold their own among the great beverages of the world, it may safely be said that cacao or chocolate is destined to take the chief place among them.

NOTES ON PRUNING.

The importance of how to prune properly and to apply some protective substance to the wound in order to prevent decay and the entrance of borers until the wound is healed has been frequently dwelt upon in various publications of this Bureau.

In the Tropical Agriculturist, T. Petch reviews a publication issued by the Tea Experiment Station in Java, relative to an extensive tarring test made by Bernard and Deuss at the abovementioned station. The experiments have shown that ordinary coal tar is a most excellent protective, which when properly applied permits the rapid healing of the cuts without any detrimental effects. On the other hand carbolic acid, carbolineum and related chemicals were found unsuitable for the purpose.

The pruning tools should be well sharpened before work begins. The cuts should be made as close as possible to the remaining part of the plant with no stubbs left. In sawing off a heavy limb great care should be taken that it does not split downward below the cut. Large branches should always be pruned so that the cut surface slopes sufficiently to carry off rain and dew. All cut surfaces of any considerable size should be painted with white lead, linseed oil or coal tar, but not so lavishly that it runs down the limb or trunk. The pruning should be performed during the dry season and all prunings should be removed at once from the plantation and burned to prevent the breeding and spread of fungi and insect pests.

ERRATA.

In the March, 1914, Review, the eighth line on page 99 begins: "Some cuttings may rot;" it should read: "Some cuttings may root." The ninth word, eleventh line, page 127 is "choice-mamey;" it should be "chico-mamey."

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[1] On leave.

PLATE I.

A very productive coconut grove near the seashore, San Enrique, Occidental Negros.

THE PHILIPPINE
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EDITORIAL.

SUGAR IN THE PHILIPPINES.

The Philippine sugar planter has been bound down by custom and tradition for many years in the manufacture of his sugars and is to this day, except for a few isolated cases, little farther advanced in this work than were his ancestors of fifty years ago. Statistics show that the yield here has been far below that of any other sugar-producing country, and the grade of the product turned out has been of such an inferior class that it ranks low in the markets of the world. Analyses show that the sugar lands here rank favorably with those of other sugar-producing countries. The rainfall and other climatic conditions are especially favorable and with a population of eight millions of people there is no reason why this should not become one of the foremost sugar-producing countries. Conditions are changing, however, and there is at present a great awakening in the sugar industry, the watchword of the day becoming "modern methods." Not alone is the Filipino becoming interested, but foreign capitalists as well, in view of the great opportunities offered here for these investments. The modern factory built at San Carlos in Occidental Negros has just finished its initial campaign and has proven to be an entire success with respect to the factory management and the planters as well. During this campaign it was proved by comparison of tests that the modern factory actually produced 24.6 per cent more 96.5° sugar than was produced by the old methods and that the selling price of this sugar in the United States was ₱8.64 ($4.32) per picul as compared with ₱4.60 ($2.30) per picul for the mascavado. Another modern but larger factory than that at San Carlos will be operated for the first time this year at Calamba. This factory will have a capacity of 1,200 tons of cane per day of twenty-four hours.

There is one important thing which must not be neglected when sugar methods are considered and this is the production of the cane. Several investors in smaller plants have recently made the mistake of first building their factories and neglecting the planting work, and as a consequence the grinding period was very short the first year.

Yields in the past in the Philippine Islands have been very low due principally to indifferent methods and poor cultivation. A circular has been prepared by this Bureau on the cultivation of sugar cane which, it is believed, will furnish suggestions of value for the planters. The advantage derived from deep plowing as compared with the shallow plowing usually practiced is clearly pointed out in this circular. The great need of fertilizers on the cane lands is shown, as well as the best method of utilizing the waste products about the plantation and factory to supply this much-needed plant-food material.

BUREAU OF AGRICULTURE CIRCULAR No. 32—SUGAR-CANE CULTIVATION.

[CIRCULAR No. 32. Manila, P. I., June 30, 1914.]

SUGAR-CANE CULTIVATION.

By C. W. HINES, *Station Superintendent.*

In general it may be said that sugar cane will thrive in practically all parts of the Tropics where the soil and meteorological conditions are at all favorable. Even desert lands where practically nothing had ever grown until irrigation water was applied have been made in recent years under modern methods to produce abundantly in this staple product.

Soil.—While sugar cane is not a plant which requires an extremely fertile soil in order to yield good returns, nevertheless it should be understood that the higher the state of fertility the greater the yield that may be expected. As a matter of fact, the successful cane lands of the world vary greatly in chemical composition as the accompanying analyses will show.

The average composition of sugar lands of the Hawaiian Islands (from Noel Deerr's Cane Sugar), in the four necessary chemical constituents, is as follows:

Lime	per cent	0.631
Potash	do	.366
Phosphoric acid	do	.268
Nitrogen	do	.290

Sugar lands of Louisiana (from Doctor Stubbs' Cultivation of Sugar Cane):

Lime	per cent	0.500
Potash	do	.400
Phosphoric acid	do	.100
Nitrogen	do	.100

Sugar lands of Java (analyzed by Kramers):

Lime	per cent	1.530
Potash	do	.079
Phosphoric acid	do	.090
Nitrogen	do	.061

Sugar lands of Negros, average analysis for seven localities:

Lime	per cent	1.660
Potash	do	.200
Phosphoric acid	do	.150
Nitrogen	do	.140

It may readily be seen that the cane lands of Negros compare very favorably with those of other sugar-producing countries.

It will be understood, however, that no series of analyses will determine the identical condition of the soil in general, since a very great difference will be encountered in the chemical and mechanical condition of soils selected even a short distance apart on the same plantation. One can therefore rely only on the individual needs and conditions of the different parts of his lands and this may be determined only by a chemical, physical, and microscopical examination as well as general observation and experimentation.

Fertilization.—In determining exactly what plant-food elements are required for a soil and the particular quantity of each, a knowledge of the total supply as well as that which is immediately available to the plant is necessary. Then experiments should be carried out with different plant-food elements, singly and in combination.

The individual planters cannot be too strongly urged to carry out these series of experiments on their own fields. This does not necessarily imply that commercial fertilizers only should be tried, but the waste products about the plantation as well, also leguminous crops, etc.

Doctor Stubbs found that each ton of Louisiana purple cane removes from the soil 0.8 pound (0.361 kilo) of lime, 2.17 pounds (0.985 kilo) of potash, 1.48 pounds (0.674 kilo) of phosphoric acid, and 1.5 pounds (0.68 kilo) of nitrogen.

A good soil should produce 75 tons of cane per hectare under proper conditions, and this often is very much exceeded. With the removal of such a crop of cane there will be taken from the soil 28.5 kilos of lime, 73 kilos of potash, 47.5 kilos of phosphoric acid, and 51 kilos of nitrogen. If none of this material is again returned to the soil and no attempt made to restore the necessary plant-food elements thus extracted, the soil is forced to diminish year by year in fertility, until eventually a state will be reached when it will no longer produce a profitable crop.

The ashes from the bagasse are usually applied to the roads or used to fill up depressions about the factory. This may be combined with the filter-press refuse and thus a complete fertilizer made for cane which may be applied with benefit on practically all cane soils.

The juice from the sugar cane contains little or no mineral matter, consequently practically all that was originally in the cane will be recovered from the ash of the bagasse; this, judiciously applied to the land where the cane was removed each year, will form the only fertilizer that is needed, excepting the nitrogen which was mostly lost in burning the bagasse. The cane lands of these Islands have been cropped for many years and consequently most of them are becoming depleted in the mineral elements required by the cane, since no attempt has been made to restore them even in the application of the bagasse ashes.

Since the climatic conditions in these Islands are such that often a great deal of water falls in a few months during the rainy season, soluble plant-food elements at this time are liable to become badly leached and thus lost to the plant. This is especially the case where soluble commercial fertilizers are applied. Another point is that the young growing plant needs these elements the most during the early stages of growth. It is therefore an excellent scheme to apply the fertilizers in two or three applications. The first, consisting of about one-third of the total amount to be applied, should be scattered in the rows immediately after the irrigation water has passed through and just before the planting is to be done. This will have the effect of locating itself in the very region where the growing plant, and particularly the young plant, needs it most. In this case it is leached downward and thus induces the roots to take that same course which brings them in contact with a supply of plant food as well as a ready supply of moisture.

Another reason why this subsoil here is often found to be quite deficient in these elements is in the fact that only very extremely shallow plowing has been practised so that no opportunity has been offered the cane to draw its necessary subsistence from the underlying ground or subsoil.

Preparation of the land.—This is one of the most important parts of the work and one that is greatly neglected in these Islands.

In the first place, the land should be thoroughly and carefully plowed. There is no danger in plowing deep for sugar cane, but on the contrary much to be gained. The roots of this plant will penetrate to a great distance if the subsoil is properly broken so that they will be within reach of a constant supply of moisture. It is asserted by some that the crop immediately following the first deep plowing is likely to be somewhat lighter than usual. This assertion may be well founded since a quantity of the undersoil is being stirred up which is likely to be deficient in nitrogen on account of there being little or no humus mixed with it the first year or so. In order to establish a system of permanent agriculture, however, it is imperative that the soil be plowed to a sufficient depth. The plowing of the tough cogon lands is somewhat difficult with the ordinary plow, and a special apparatus for this work was devised by the Bureau of Agriculture to meet the conditions in these Islands.

The land should next be cross-plowed either with disk or moldboard plow and then worked to a fine physical condition by the use of disks, harrows, rollers, etc. Too little attention is ordinarily paid to the packing of the soil after it has been thoroughly worked into a fine mechanical condition. One purpose of thoroughly stirring the ground to a good depth is to properly aërate it, since both sunlight and air are essential to bacterial development in the soil. Certain nitrogen-bearing fertilizers are made available to the plant by this bacterial action. Stirring also loosens up the soil so that the rootlets may penetrate it and aid capillarity so that the water will be brought nearer the surface. The packing of the land with a heavy roller as well as the formation of a mulch of fine dirt over the top has the effect of preventing this moisture from escaping by evaporation. The light soils which suffer badly during the dry season in particular should be treated in this manner. By this means many of the districts which have hitherto produced little in growth during the dry season may be made not only to remain green, but also to grow a great deal as well.

Just before the land is to be planted it should be furrowed out in rows 1½ meters apart. This furrowing may best be done with a form of the large single-shovel plow which throws the dirt up on both sides. (See fig. 1.) Hoes may be used to clean out the furrow thus formed, but they should never be used solely for the work of furrowing out since this requires an excessive amount of labor and is altogether unsatisfactory. These furrows should be made from 20 to 30 centimeters deep, depending upon the condition of the soil and the subsequent method proposed.

Seed and its preparation.—Only the immature cuttings should be used for planting, since upon reaching maturity the cane becomes woody and loses its ability to send forth new shoots. Where cane is left until full maturity is reached, as in the case of milling, only the topmost joints which are green and contain good eyes should be used. Where it is desired to plant a large area, however, and where there is indication of a limited supply of points during milling time, the cane may be cut early and the whole stalk used for planting.

It is imperative that points should be selected from the best varieties grown in fields free from insect pests and from those which have proved a success in that locality. The points should be cut of such a length that they will each contain two or three good eyes. They should then be placed in piles or tied in bundles and protected from the sun and dry air which would cause them to dry out too much. Likewise, they should be kept from excessive moisture until their final preparation for planting, which will consist of soaking them in clear running water from twenty-four to forty-eight hours before planting. The length of time that they should be soaked will depend upon the kind of points, condition, etc. In no instance should they be allowed to remain in the water until deterioration begins.

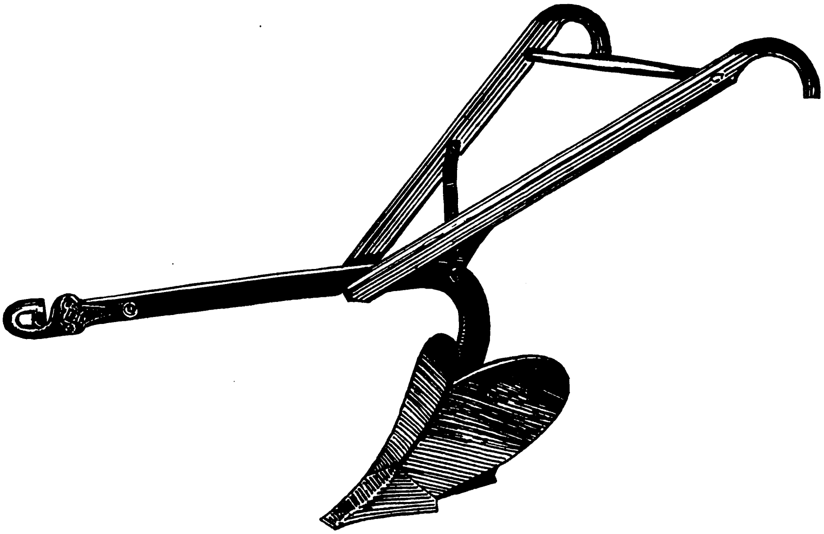


FIG. 1. Single-shovel plow for furrowing out rows.

Irrigation.—If water is available for irrigation it is well to make the first application a short time before the cane is to be planted. This may be done by allowing the water to move slowly down the furrows in order to give it an opportunity to be taken up by the surrounding soil and thus form a ready supply of moisture for the cane. Subsequent applications of water may be made in the cane rows over the cane until they are thoroughly filled up and then through a furrow along near the cane rows. There is nothing that pays better than the irrigation of sugar cane during the dry season, and yet this so important a point is grossly neglected practically everywhere in the Philippine Islands. Even where but a limited supply of water is available, as from the small artesian wells, it should be applied on the area it is capable of watering. In many places there are rivers which may be dammed up causing the water to rise so that but a very small lift would be required to bring it to the cane fields.

Although sugar cane requires a great deal of water for successful growth, yet it must not be permitted to remain over the cane for any length of time, nor should the land be so saturated that the roots will be in contact with stagnant water, for such a condition will cause them to rapidly die off.

Planting.—In planting the cane it may either be placed flat in the row or inclined at an angle of about 45°; the latter is to be preferred where the ground is not too dry. The points should be placed from 4 to 20 centimeters apart in the row, depending upon their condition, vitality, etc. It must be borne in mind that cane can ripen well only where it has full space for expansion and also that cane planted moderately thin will stool better than that planted thick in the row. It should then be covered with 4 or 5 centimeters of fine earth and at each cultivation more earth thrown on until the rows are level with the rest of the ground—or they may be even hilled up during the latter part of the cultivating season. This has the effect of stimulating root growth which will greatly aid in supporting the cane during wind storms. It also induces the growth of new shoots thus increasing the yield of cane per hectare. Any points which have not germinated should be replanted as soon as possible after they are detected, and this work of replanting should be continued as long as there are any blank spaces.

Cultivation of the cane.—Nothing is more harmful to growing cane than a hard crust on the top of the ground caused by the action of the sun upon soil that has become run together after rains or irrigation. This has the effect of preventing the proper aëration of the soil which is so essential to bacterial growth.

Careful and thorough cultivation must be practised during the growing season after the ground becomes sufficiently dry and this should be done fairly deep in order to loosen the soil so that the new roots can better penetrate it.

Weeds and grass which are so inimical to plant growth will also be destroyed by proper cultivation.

The best implement to use in this work will depend very much upon the class of soil, period of growth, etc. Shovel cultivators in modern agriculture are very effective. Occasional hoeing, however, should be given to remove the weeds inaccessible to the plow. It is a mistaken idea that cane cultivation must be done only by the use of hand hoes. This is not nearly so thorough as the cultivation with plows and other implements; furthermore, it is expensive since it requires much labor, and fails to loosen up the subsurface which is necessary to proper root development.

Harvesting the cane.—The proper time for harvesting the cane is a factor which has been very much neglected by many of the planters in these Islands. If the cane is harvested too early the percentage of sucrose will be low, and the purity of the juice, which is one of the deciding factors in sugar yields, will also be low. The tonnage of cane per hectare, too, will be lower than if opportunity had been given for the cane to reach full development.

The proper method of determining when the cane is ready to harvest is to take a number of average stalks to a chemist who will press out the juice and make an analysis of it. This should be done from time to time in order to determine the exact time of maturity, at which time the cane will contain the maximum amount of sugar.

There is no set rule as to what percentage sucrose and purity should reach before harvesting begins. This will depend upon the season, the individual variety of cane, soil, etc. It is known that some varieties reach a certain percentage of purity while others may go a great deal lower or higher when grown under the same conditions.

The cane is usually cut with an ordinary "bolo," or cutlass, and often each individual man in the field will have a different form of knife, some of which are very heavy. The knife shown in figure 2 is the best implement for this purpose. The back of this blade contains a hook which serves to remove the leaves and rough material as well as to aid in bringing the stalk nearer the operator. Another advantage in the use of this knife is its light weight as compared with that of others now employed.

After the cane is cut it should be sent to the factory and milled as soon as possible. Results of various investigations have proved that there is a great loss of sucrose by inversion when cane remains for some time after cutting.

Ratooning.—Wherever it is practical, ratooning should be encouraged since it is a great saving in labor and cane seed.

The usual custom here is to harvest a plant crop and occasionally one ratoon crop. In Cuba it is customary to remove six or eight ratoon crops, and sometimes more, from the rich lands. One reason why ratooning has not been practised successfully here is on account of the depleted condition of the soil in the elements required by the cane, due to many years of cropping. In order to successfully produce ratoon crops the old stubble should be cleared out, and the leaves and trash brought to the center of the rows and plowed under, instead of the ordinary burning which injures the topmost roots and growing stalks. The ground near the rows should be stirred and a good sugar-cane fertilizer applied by drilling it in near the rows or hoeing it in near the different stools.

All vacant places should be properly filled out at this time in order to maintain a uniform stand.

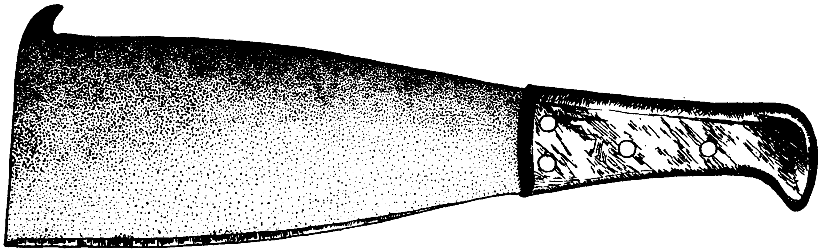


FIG. 2. Harvesting knife for sugar cane.

Irrigation water should next be turned on and the ground thoroughly soaked, care being taken that the fertilizer applied near the stools is not washed away should there be an excessive slope in the land.

If the above method is judiciously carried out there is no reason why ratoon crops practically as heavy as the plant cane cannot be reaped.

Experiments.—Each planter should carry out a series of individual experiments on his land in order to ascertain what variety of cane, kind of fertilizer, method of fertilization, method of cultivation, irrigation, etc., is better for him to follow on his own particular land. First of all, it is imperative that a definite plan be decided upon and specific ends sought in all experimental work. It must also be borne in mind that only absolutely authentic data will be of any service. A suitable location should be selected for this work where a uniformity of soil and other conditions may be had, either somewhere in the field of cane being planted, or a separate plot may be measured off and properly prepared. A very good scheme to follow is illustrated in figure 3.

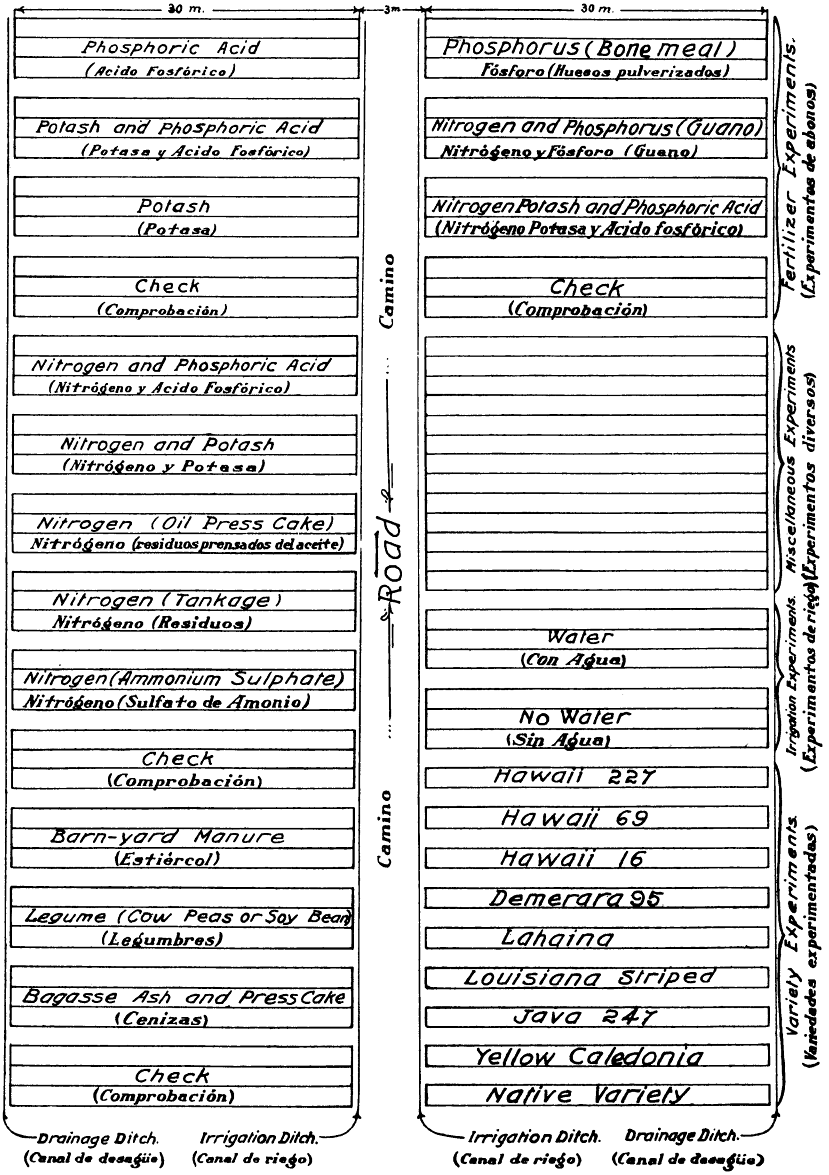


FIG. 3. General plan for experimental plots.

If irrigation experiments are to be made, the land should be so laid out as to give a gradual fall in order that the water may pass the entire length of the row. Care should be taken that this fall is not too great since in this case the water would pass rapidly down the rows without penetrating the soil. A drainage ditch must always be provided to carry off excess irrigation water as well as to serve for drainage during the rainy season.

As it is desirable to make a comparison with standard methods, check plots should be left for this purpose among the other plots.

In carrying out the fertilizer tests, it is desirable to know the particular plant-food elements needed and the quantity of each that will give the maximum returns to the planter. With this end in view, it is well to plan a number of experiments using different quantities of the fertilizing elements which have been found deficient by the former experiments.

COPRA DRYING.

By C. W. HINES, *Station Superintendent.*

The coconut industry ranks among the most profitable industries in tropical countries, where conditions are at all favorable for the growth of the coconut tree. Here in the Philippines, it is grown extensively in some 16 provinces which supply about one-third of the world's output of dried copra. It seems very peculiar that more modern methods in the drying of this copra and in the extraction of the oil are not found. To the writer's knowledge there is but one modern factory turning out this oil in Manila to-day, the majority of the raw product being exported to the United States and to foreign countries.

GRADE OF COPRA FROM THE PHILIPPINES.

The greater part of the copra produced here is of poor quality, on account of the methods used in handling and drying. Besides the objectionable dark color due to the long time required in drying and the effect of the smoke on the white meat of the copra, there are one or two other factors which have even greater influence. The first of these is the high moisture content of the dried copra. This is the main cause of most of the bacterial and mold formation on the copra, which not alone causes the finished product to present a bad appearance, but lowers the percentage of recoverable oil, as well as raising the percentage of free, fatty acids and other impurities. This, of course, also increases the expense to the manufacturer.

PROPER MOISTURE CONTENT.

In order to keep in good condition, copra must be sufficiently dried to prevent this bacterial attack. Numerous experiments have proved that under ordinary conditions, copra containing 5 per cent or less of water will keep perfectly, even during the wet season. Of course, well-dried copra will take on a slight amount of moisture during wet weather, but this will not cause any great harm if the copra was thoroughly dried previously. The greatest destruction comes when the moisture content is from 10 to 16 per cent. At this time the different molds thrive best and consequently cause the greatest deterioration of the oil of hydrolization. A moisture content between this and the standard 5 per cent will prove somewhat less favorable to the bacterial action as well as to the mold growth, but this will still be destructive to the copra and cause a decrease in value.

SUN-DRIED COPRA.

The ordinary sun-dried copra on the market contains from 8 to 14 per cent moisture, which fully accounts for its very poor condition after standing a short time. This copra often contains as high as 3 per cent fatty acid, which is a waste product derived from the valuable oil of the copra. The buyers of this grade of copra would necessarily be forced to pay much less per ton than for a prime article. In the first place, the appearance is very much impaired and, secondly, there is a loss in the oil content.

It is easy to see, then, why the producer of low-grade copra receives a lower price for his product than does a neighbor who uses an up-to-date apparatus requiring but four or five hours for complete drying. In case of cloudy weather or showers, the task of sun drying becomes more difficult, and when continued rains prevail, as during the wet season, the task is almost impossible.

OPEN-FIRE DRYING.

In this method of drying, a framework is built of bamboo, about 1 meter from the ground, and on this the split nuts are laid. A fire is then built underneath with the husks and shells from the nuts. No attempt is made to carry away the smoke from the drying coconut meat, nor is there any special provision made to prevent the superheating of certain parts. The usual result of these two evils is a very dark and badly smoked copra, while quite often a large percentage is partly charred. In some regions this method is practiced quite extensively, while in others it is used only during the rainy season. It is obvious that only a low-grade copra will ordinarily result from either of the above methods, yet it is strange that the greater part of the copra from these Islands is produced in this manner.

MODERN DRYING APPARATUS.

In modern manufacture ovens specially constructed are used in drying sugars, cacao, fruit, etc. Only recently have several apparatus been introduced for the drying of copra by artificial means. As far as the grade of copra is concerned, they have thoroughly demonstrated their superiority over the antiquated methods by turning out a perfectly white copra with splendid keeping qualities. The time required for this drying to a moisture content of 5 per cent is from four to six hours. This is, of course, a great saving of time, and gives the producer an opportunity to secure the top price for his product. While these apparatus are comparatively new, and still in the experimental stage, yet there is no doubt but that the right method of heat transmission has been discovered, and this is one of the most important factors. Another factor, of perhaps as great importance, is the ability of the operator to maintain the desired temperature at the different stages of drying.

Steam drier.—Some time ago the Bureau of Agriculture introduced a drier containing a series of 2-inch (50-millimeter) tubes, placed near the bottom, through which the steam for drying the copra was introduced. The grade of copra produced by this apparatus was very good and it was found that perfect control could be had in the manipulation of the drier. The steam in this case was produced from the husks and shells of the coconuts under an ordinary boiler.

Another drier has been in use in Laguna Province which aims at a better distribution of the heat by having its steam pipes arranged through the apparatus at various heights instead of at the bottom only.

The Mayfarth drier.—This apparatus is built on distinctly different plans from the above. A blast of hot air furnishes the heating medium, and the partly dried nuts are moved along during the drying by means of a mechanical arrangement propelled by an operator. This apparatus was subjected to extensive experiments during the past year by the Compañía Tabacalera of Manila.

To the writer's knowledge there are none of these driers in operation on plantations here to-day.

McChesney's hot-air copra drier.—This represents one of the latest designs and one of the very best that has been introduced, so far as the quality of the dried product is concerned. (See Plate II.) The principle upon which this operates is that air heated in a metal oven placed above the furnace is forced through a series of pipes containing perforations, and thus an air pressure is maintained in the oven itself until a certain amount of the water has been removed. The broken nuts are placed in trays and left to dry for about one hour at a temperature of 90° or 95° after which the shells may be easily removed and the meat cut into strips, which are again placed in trays and dried for about three hours. The temperature during this time is maintained as high as possible without causing decomposition of the tissue, which will result from excessive heat. About three or four hours of this second drying is usually sufficient to produce a first-class copra.

PROPER METHOD OF DRYING.

When the drying is first begun the temperature may be allowed to reach 95° or even 98° until the nuts are ready to be removed from the shell, after which about 85° should be the maximum temperature for the first hour and then a gradual drop should obtain for the two succeeding hours until 65° is reached. Great care must be exercised when the final product is nearly secured, since at this time decomposition from heat may easily result. It is thus better to use a lower temperature and more time during the final drying. Copra dried under these conditions and properly packed should keep well and contain a minimum of fatty acid. Such copra should therefore command the highest price in foreign markets, and cost the producer probably less, or at least no more, than copra obtained by the old methods. One advantage in producing a superior article in any line is that there is always a sure and steady market for this product as well as an opportunity to secure the highest market price.

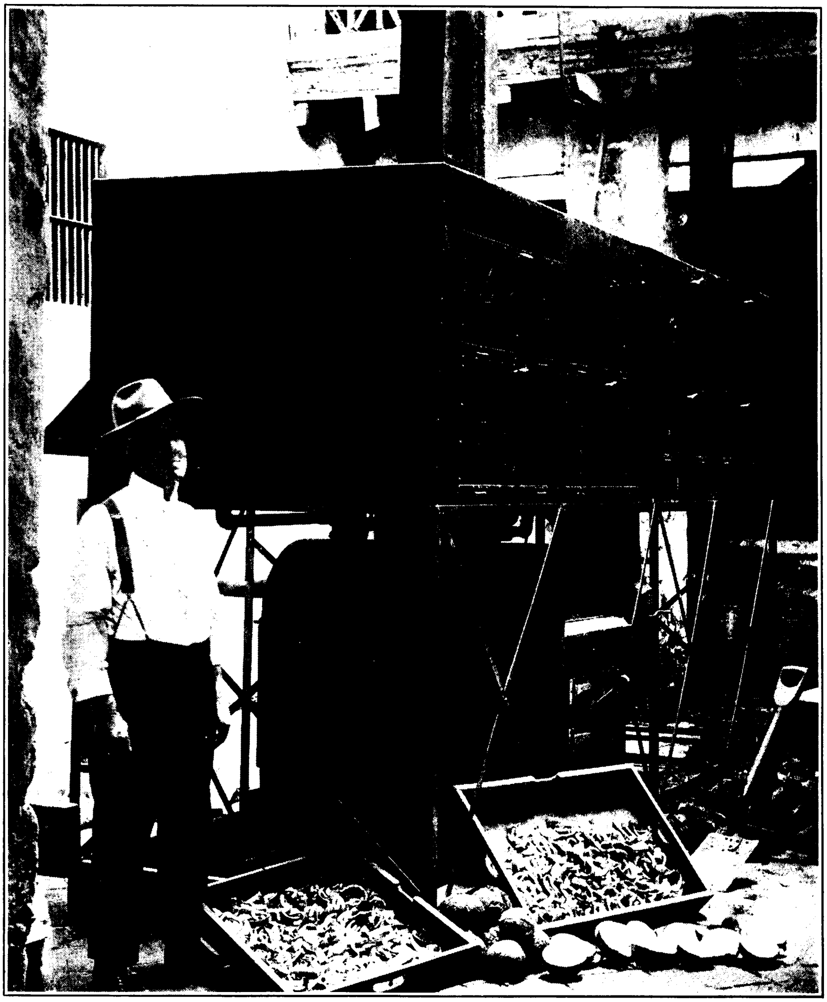
THE MANUFACTURE OF OIL.

The percentage of oil contained in the fresh meat of the coconut usually runs from about 30 to 45 per cent. The percentage contained in the dried product will be largely governed by the percentage of moisture remaining. It will, of course, contain a lower percentage of oil than the oven-dried, which will often reach 70 to 80 per cent when its moisture content has been greatly reduced.

There are two processes commonly used in extracting this oil—the hydraulic and the continuous. The former usually gives a higher extraction but is slower in operation than the latter. Both processes are used in America and Europe. The continuous-process method is an American invention.

The press cake remaining after the oil is removed makes a valuable cattle feed and also an excellent fertilizer. In either case it is well that only a very low oil content remain.

Sometimes a solvent is used in the extraction of oil and it is imperative that this chemical be noninjurious to the animals, should the press cake be used as a stock feed.



McChesney's hot-air copra drier.

SUGGESTIONS FOR THE CARE OF HORSES IN THE PHILIPPINE ISLANDS.

By Dr. W. R. L. Best.

Inquiries are frequently made as to what breed of horses is best adapted to conditions as they exist in the Philippine Islands. The classes of work for which horses are used may be safely stated as coming under the following four divisions: (*a*) Carromata and carretela; (*b*) saddle; (*c*) packing; (*d*) racing; all of these are performed by the lighter types. Heavy hauling and plowing being work requiring the heavy or draft types is accomplished in this country by the carabao or bullock. Under these circumstances the breed that best suits the conditions and the markets should be chosen. There is no best breed or type for all purposes.

Because of the profit to be derived from raising a few colts it would seem to be of advantage to the average farmer to keep brood mares with which to carry on his operations. These mares should be of good quality so as to produce colts that will command a premium on the market, especially as it will cost as much to maintain a cheap as a good horse. Care should be exercised in selecting the sire, because if animals of poor conformation are used for breeding purposes inferior colts must be expected.

Care of mare and foal.—Moderate work is not only harmless, but positively advantageous to mares in foal, providing proper care is taken not to overload them. This is much better than to keep them tied in the stable, for in that case they suffer for want of exercise; if they are permitted to run at large in the fields with other horses they are also exposed to accidents. If proper care is taken, the mare can be used safely at ordinary work up to within a few days of foaling. As the time approaches it is important that the work be not heavy or the pace rapid, and she must not be fretted by other horses or by rough, inexperienced hands.

It is essential that the new-born foal get the first milk from the dam. This first milk is a natural purgative, and contains principles adapted for the removal of material which has accumulated in the digestive tract of the foal during the last few days of fœtal development. The prompt removal of this material is essential to the life of the foal, and for this reason it is highly necessary that it be supplied with the first milk from the dam.

Early training of colts.—An important advantage gained by early training of a colt is that it becomes acquainted with its master at a time when man is the physical superior. The earlier in life the training begins, the easier is the task; and the longer it is postponed, the greater are the chances of a hard struggle. It is easier to show than to force the colt to do that which it does not understand, and thus fix the idea in the animal's mind that man is its mental and physical superior. For these reasons the colt should be taught to lead, to back, and to obey simple commands before it is 1 month of age.

Age at which a colt should work.—There are many opinions as to the proper age at which a colt should be trained for work. Some horsemen believe that the horse should not be worked until nearly 4 years old, while others think a more useful animal will result if put to light work at 2½ or 3 years of age. It would seem that these ages might well represent the extremes. As a rule, the horse should not be put to work under 2½ years, and even then the work should be light and the working hours short. If the work is too severe or continued for too long a time the animal will be retarded in its growth and will not make as useful a horse as if the training had been delayed a few months. On the other hand, if the horse is thrifty, it is poor economy to keep it in idleness after 4 years of age.

Breeding age of filly.—The age at which a filly should be bred depends on conditions. If well matured she can be bred when 2 years old, but it would be poor policy to breed if not well matured. There is considerable difference in the way mares mature—light types requiring longer than draft types.

Feeding.—In general, the working horse should be supplied with something over 1 kilo of food daily for each 50 kilos of weight. Of this, about one-half or two-thirds—the exact amount depending on the severity of the labor performed—should be grain in some form. If the work is exceedingly heavy, the grain in the ration should be increased and the hay or grass diminished; on the other hand, if the work is light, the grain should be diminished and the hay or grass increased. The morning and noon meal should be comparatively light, consisting mostly of grain, so that the heavy feed will come at night when the animal has sufficient time to eat and digest the feed, and is not obliged to go to work immediately after eating.

While the foods that enter into the ration may consist largely of such as are available, yet a grain mixture consisting of half corn and half palay, by weight, fed in connection with hay or grass, cannot as a rule be greatly improved upon. In feeding the working horse a very good practice is as follows:

For the morning ration feed one-fourth the daily allowance at least one hour before going to work. It should be in condition to be easily and rapidly consumed so as to be well out of the way when the horse is led from the stable. After being watered he is ready for the morning's work. At the end of approximately four and one-half hours of labor he should be given the midday ration.

When he comes to the stable or resting place he should have a drink of fresh cool water, but care should be taken that he does not drink too rapidly or gorge himself if very warm; another quarter of the day's allowance may now be fed and, if possible, the harness should be removed so that the animal can eat his meal in quiet and comfort and gain a few minutes of rest. He should have two hours to consume the meal. After being watered again he is ready for the afternoon's work. As in the morning, after about four and one-half hours of labor he should be fed the evening ration. When the horse comes to the stable or resting place in the evening, tired and warm, he should be unharnessed at once and be given a fresh, cool drink, care being taken that he does not drink too rapidly. He is now ready for the remainder of the day's allowance. When the sweat has dried, a thorough brushing should be given.

Horses that are aged will, on general principals, take more feed as their teeth are not generally in good shape for grinding the food, and hence they would not receive so much nutrition from it.

The horse needs a longer time for digestion and for this reason he should not be put to work so soon after eating as the ruminating animals like the bullock or carabao. It requires energy for the horse to grind the food in the mouth, and this usually can be done more cheaply by the millstones than by the horse's grinders.

Watering.—It is advisable that animals be watered before being fed, or that an interval of an hour or more intervene between the feeding of grain and grass and watering.

The theory is that water washes the stomach contents into the intestines before digestion is complete, thereby producing indigestion. However, if animals are accustomed to being watered after feeding grain there is usually no injurious effect.

The giving of food and water to horses in a heated condition is a bad practice and is liable to terminate in serious results. The presence of food in the stomach produces a sudden activity in digestion which may cause colic or other troubles. Cold water may produce founder or other disturbances, because of the sudden contact with the warm, overheated tissues.

Unhealthy appearance.—When a horse's hair becomes rough and stands up, and the skin becomes scaly, it is usually attributed to various causes, such as bad teeth, indigestion, general lack of condition, or too frequent washing. The teeth should be examined by a veterinarian and, if necessary, treated. The use of a condition powder may be advisable if the animal shows no particular symptoms that would account for the trouble. Frequent washing removes the natural oil from the skin, thus leaving the hair dry, dusty, and rough. This is a very common practice of horse owners throughout the Islands, and should be discontinued if a nice glossy-coated horse is desired. There is nothing more conducive to this than a good stiff brush, a soft body brush, and a dusting rag, which if properly used will add pesos to the value of the horse. The use of a small amount of kerosene on a cloth applied to the coat of a horse is of advantage, since it has a stimulating effect upon the pores of the skin and makes the coat more glossy.

Care of the horse's teeth.—Horses' teeth require constant attention. The upper jaw is somewhat wider than the lower so that the teeth are not exactly opposite and sharp edges are often left unworn on the inside of the lower jaw and on the outside of the upper, which may cut the tongue or cheeks. When these sharp edges are found the assistance of a competent veterinarian should be sought who can relieve the conditions with a guarded rasp made especially for that purpose.

Injuries to the neck, back, or shoulders.—Sores on the top of the horse's neck, under the collar or breast strap, or on the back are difficult to heal. Thorough washing with a good disinfectant is advisable and healing will be much more rapid if the animal can be allowed to rest or is not used in such a way as to irritate the unhealthy places. The failure to heal in cases of sore neck, back, or shoulders is due to the continual irritation produced by the collar, saddle, or breast strap and possibly a debilitated condition of the animal. If the skin is not broken, bathing the shoulder frequently with clean, cold water may be of value. The application of sugar of lead—20 grains to an ounce of water—will help to heal the wounds and toughen the shoulders.

Injuries to knees and fetlocks.—Knuckling and sprung knees are common ailments rather difficult to overcome unless it be during the first stages of the trouble. First of all the horse needs rest. Careful attention should be given to the condition of the feet, to the manner of shoeing, and to the slant of the floor upon which the horse is standing, while time should be allowed for the tendons to become restored to their normal state and for the irritation caused by excessive stretching to subside. A shoe with a thick heel will help to remedy these troubles.

Care of feet.—In most sections of the country horses should not be driven on the hard roads without shoes, as their feet are not tough enough to withstand the wear. The shoes should not be left on too long as the hoof grows out to such a length that it throws the foot out of its proper axis, thus causing an overloading of certain parts which results in unsound legs. Because of the importance of sound feet and legs, the feet should be shod once each month. If the hoof becomes dry, hard, and brittle, a good hoof dressing applied once or twice a week will be of benefit. If the animal is being used on moist soil it will be unnecessary to use the hoof dressing in most cases.

Daily examination of the foot should be made for nails or foreign bodies. In case of sudden lameness always examine the foot thoroughly for such objects.

Castration of males not desired as sires.—Many people are of the opinion that castration has a tendency to weaken or make the horse slow or sluggish in his work. This is a mistaken idea, as an entire horse usually expends a certain amount of energy in fretting or other ways, thus diminishing his working powers. By castration this loss of power is eliminated and the energy thus saved renders the horse more useful for work purposes. In addition, vicious horses, after castration, often become docile and are more easily handled, retaining just as much strength and vigor as they had before. In the case of young horses, it is best to castrate at the age of 1 year.

CURRENT NOTES—AUGUST.

NOTES BY O. W. BARRETT, Chief Division of Horticulture.

[From the Daily Consular and Trade Reports of the United States Department of Commerce.]

AGRICULTURE IN ITALY.

Italy has begun active measures in the way of building up the agriculture of her new colony, Libia, or Tripoli, in North Africa. "Experts are in the field collecting data and soon the Government will be in possession of valuable information by which it will be enabled to formulate plans for the colonizing of lands that have lain idle for centuries * * *. Intensive farming in the oasis will be encouraged by the demand from new markets for vegetables and fruits that can be grown here in the off season."

CARDAMOMS IN CEYLON.

The export value of Ceylon cardamoms is approximately half a million pesos per annum. This very valuable spice crop which has just been introduced into the Philippine Islands can be grown on any of the rich forest lands of this country. In Colombo the cost of cultivation is said to be about ₱1.40 per kilo and the wholesale selling price about twice as much. Part of the increased interest now in evidence with reference to this crop is due to the fact that cardamom oil is at present used to a considerable extent in the perfume trade as well as in medicine and cooking.

COPRA IN THE MALDIVES.

Better connection between the Maldive Islands and Ceylon will, it is expected, soon result in a much greater copra export from that little-known archipelago, lying some 640 kilometers west of the southern point of India.

A NEW AND VERY SERIOUS DANGER TO THE COCONUT-OIL TRADE.

According to the Daily Consular and Trade Reports of March 6, 1914, of the Department of Commerce, Washington, D. C., a firm has just installed in West Africa a plant for expressing *edible* palm oil. It is quite within the range of possibilities, of course, that modern chemical processes can, or soon will be able to, remove the acrid and probably more or less poisonous qualities of the West African oil palm which has hitherto been used almost entirely in the manufacture of soaps and axle grease for railway carriages. The West African oil-palm tallow has a rather high melting point (75 to 100° F.) and a rather attractive natural color, which probably would disappear, however, in the complicated chemical processes for the removal of the objectionable constituents.

In short, if the new processes of treating the almost inexhaustible supply of palm tallow prove quite practicable, the price of copra must inevitably fall unless at the same time there is a considerable demand for the latter and much more safe (as a human food) product.

GALANGAL, OR WILD GINGER.

Galangal (*Alpinia officinarum*) is a promising crop in South China. It is exported to the United States, classed as ginger, and used as a cheap flavoring spice. In taste it resembles a combination of ginger and pepper; the aroma is very pleasant.

NOTES BY C. W. EDWARDS, Chief, Division of Animal Husbandry.

INCUBATION OF EGGS IN EGYPT.

The art of hatching fowls' eggs by means of artificial heat has been known and practiced by the Egyptians for five thousand years or more. The process is accomplished by the use of mud ovens, the greater number of these establishments being found along the Nile from Alexandria to Aswan.

The hatching season extends from February to May and it is estimated that approximately 90 millions of eggs are hatched annually by this ancient process. There are approximately 500 of these hatcheries throughout Egypt. The entire building is constructed of mud and brick with a dome-shaped opening on the upper roof for the escape of smoke. The ovens proper are located in two parallel rows separated by vaulted passages containing chambers for the newly hatched chicks. The entire incubator also comprises an ignition room and often other compartments for the storage of eggs and fuel and living quarters for the attendant. Each oven contains two cells or compartments, the fuel being placed around the side of the floor of the upper chamber in troughs provided for this purpose. Each cell is provided with a passage or opening just large enough to allow the attendant to enter. The hatching chambers are heated for a few days before "placing" the eggs and when a sufficient number have been collected they are spread in a layer on the floor of the lower cells and after a few days some are transferred to the upper chambers.

No thermometers are used to maintain proper temperature. This is judged by the manager by holding the egg against the delicate skin of the eyelid and other parts of the body and by placing the hand on the walls of the oven. These managers are said to become very expert, being able to determine with a remarkable degree of accuracy the necessary temperature. The eggs are turned two or three times daily and tested after the fifth or seventh day by holding them up to a ray light. The infertile ones are sold for human consumption.

It is said that the average of hatch from this process of incubation is about 65 per cent.

IMPORTATION OF CHINESE EGGS INTO THE UNITED STATES.

Recent tariff legislation in the United States placed eggs on the free list. One of the direct effects of such legislation has been the importation by Pacific coast dealers of thousands of Chinese eggs. These are placed on the market and sold for one-half or less than the locally produced product. They are offered as fresh eggs and in many cases can not be distinguished from the home product. This is regarded by the coast poultrymen as unfair competition and efforts are being put forth by the various poultry organizations to obviate what they regard as a grave danger to the industry. Among the suggestions proposed, that of making it obligatory on the part of the dealers to label each egg with the date of importation and the word "Chinese," seems to be considered with most favor.

HAVANA LIVE-STOCK EXPOSITION.

A very creditable and interesting live-stock exposition was recently held at Havana, Cuba, at which were shown, aside from local stock, entries from the United States, South Africa, and Holland.

Many of the problems confronting the Cuban live-stock growers are similar to those met with in this country and it is interesting to note the progress which has been made by the former, through Government assistance, in upgrading the native stock and the development of new types suitable to the country.

The exhibit was held much after the manner of conducting our local expositions, the event being fostered and supervised by the Agricultural Department. Feed and attendants were furnished gratis and no stall fees were charged.

Particular interest to the industry in this country is found in the classes of South African and Indian cattle and the crosses by Indian (Zebu) sires out of grade Holstein and grade Hereford dams. The French *Charolaise* cattle, which are a dual-purpose type, were given special mention and spoken of as well adapted to Cuban conditions, being good work and meat animals and doing fairly well at the pail.

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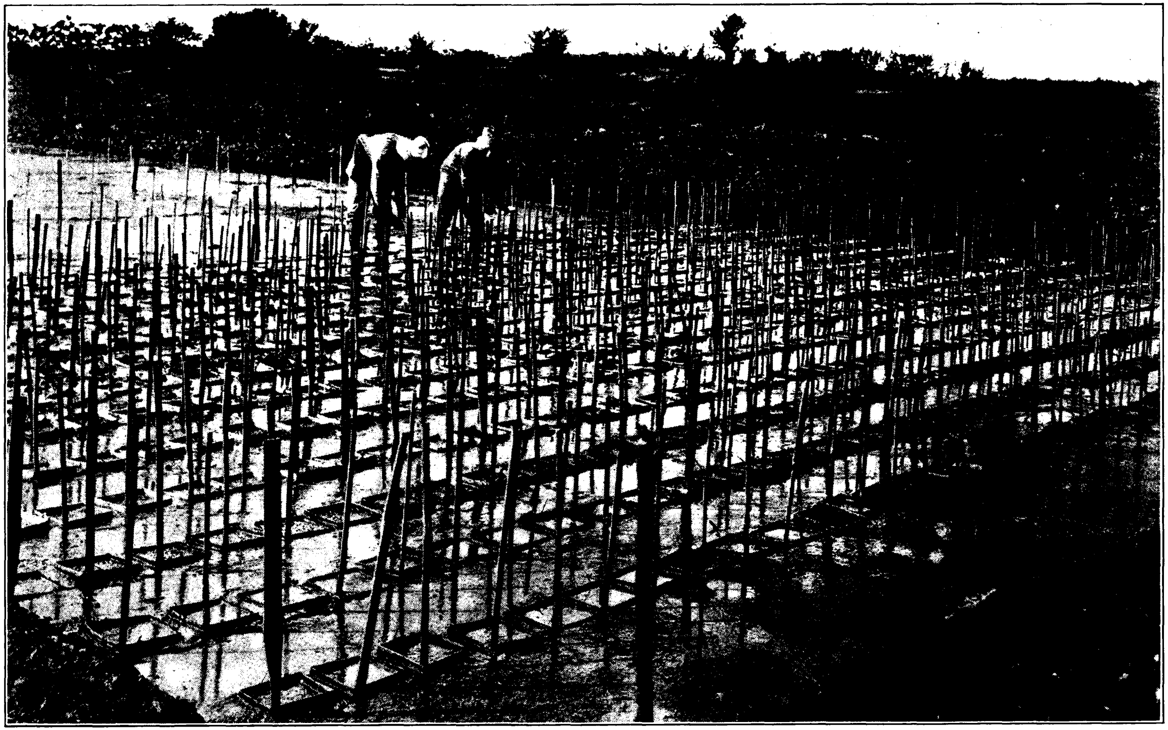

Showing method of preparing nursery beds in the head-to-the-row test with rice.

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EDITORIAL.

The fact that there is individuality in plants has been acknowledged but very recently.

This feature was recognized ages ago as an economic factor in the production of animals; horsemen, for instance, learned that the offspring of certain sires possessed desirable qualities transmitted by the parent. Horticulturists learned that certain fruit trees had individual qualities, which were transmitted to their progeny, and it was slowly but surely determined that one tree of a number of a given variety had certain characteristics not generally obtaining throughout that variety. With sugar beets, individuals were found that produced more sugar than other individuals of the same variety.

In the United States, with corn, great stress was placed on the discovery that given individuals possessed tremendous producing capacity when compared with other individuals of the same variety and similar appearance. As a consequence, wherever this principle has been recognized and applied, great gains in production have been secured, and at the same time the cost of production has been effectively lowered.

During the past ten years attention has been centered on the operation of this principle in the isolation of individuals in the grass family, and wonderful results have been obtained. One investigator has found a single wheat plant from which has been developed a highly productive and profitable variety. Another has found a barley plant, and so forth. In each case the individual has been far superior to the race or family from which it was removed.

The world has long since learned that merely because a man is a member of a given nation or family he is by no means identical with any other member of that nation or family. Individuality has been recognized and acknowledged.

We are now learning that even in a rice field every plant is not necessarily like any other rice plant or plants of that particular variety. In one field, for instance, there are numberless individuals, some of which are capable of producing but few grains, which, when planted, will in turn produce but little.

On the other hand, in that same field are individuals which possess an inborn capacity to produce much grain and, furthermore, can transmit that capacity to their progeny.

There is nothing so potent for good in plant industry to-day as the knowledge that production can be largely increased, and desirable qualities enhanced, by the simple means of seed selection.

It is a power that may be employed by anyone engaged in plant production. None are so poor, and few if any are so ignorant, that they are unable to utilize it.

It is extremely unfortunate for the Philippines that this wonderful force has been neglected by its farmers, especially in the treatment of the two most important food crops—rice and corn. The corn field is stripped of the choicest ears for sale or home use and the seed is selected from the culls. The earliest and best rice is sold or used for food, and the seed is saved from the inferior part of the crop. Herein lies the main reason for our low yields, as the best crops are never produced from poor seed, and the fact that this has been done unconciously does not remedy the evil.

It is within the power of each rice and corn grower to materially increase his crop at no added expense and with very little trouble. The information necessary to do this is easily available, and with it only one thing more is necessary, and that is practice.

LOCUST REGULATIONS.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
EXECUTIVE BUREAU.

MANILA, *August 22, 1914.*

EXECUTIVE ORDER
No. 72.

Experience in connection with the present campaign against locusts has demonstrated that good organization and uniform regulations are necessary to control the locust pest. For the purpose of insuring such good organization and having such uniform regulations, the locust board in each province is earnestly urged to adopt the following regulations approved by the Director of Agriculture:

REGULATIONS.

1. In accordance with section 1 of Act No. 2121, there shall be organized in each province a board to be known as the locust board, such board to be composed of four members to be appointed by the Director of Agriculture on the recommendation of the provincial board and of the members of the provincial board.

2. The locust board shall elect one of its members as secretary, whose duties shall be:

(1) To keep a list showing—

(*a*) The number and names of municipalities infested with locusts, or wherein deposit of locust eggs exists.

(*b*) The date of appearance of locusts or deposit of locust eggs in each municipality.

(*c*) The stage of development of the pest in each municipality (eggs, hoppers, or fliers).

(*d*) Source and movements of winged swarms.

(*e*) Number of inhabitants in each municipality available for service in the locust destruction, exclusive of those exempted by Act No. 834.

(*f*) The locust equipment in each municipality.

And (2) to render, on Bureau of Agriculture Form 92 (supplied by said Bureau), a monthly locust report to the provincial Governor, who shall forward a copy thereof to the Director of Agriculture.

3. It shall be the duty of any person discovering locusts, or having knowledge of the presence of the same, to report immediately the existence of such locusts to the lieutenant of the barrio, municipal councilor for the district, or to the president of the municipality in which said pest occurs. Upon the lieutenant of the barrio or the municipal councilor for the district being so informed, or upon having knowledge of the appearance of locusts in any other way, he shall bring the fact at once to the attention of the municipal president. The latter, upon being so informed, shall take the necessary measures without delay to supress the pest, and at the same time bring the fact to the notice of the locust board through the provincial governor.

4. It shall be the duty of all officials of the municipality in which the locust pest may exist to execute orders of, and comply with the regulations promulgated by, the locust board under the supervision of said board as well as of the representative or representatives of the Government duly authorized to take charge of the campaign, should any such representative or representatives be present.

5. It shall be the duty of the municipal president or his authorized agent to note the nature, movements, and extent of the swarms; to keep a list showing the locust equipment of his municipality and the number and names of all able-bodied inhabitants of his municipality available for service in the event of locust invasion; to call upon such inhabitants to render service in accordance with Act No. 2121, as hereinafter provided, and to submit to the locust board a weekly report showing—

(*a*) The number and names of barrios infested with locusts, or wherein deposit of locust eggs exists.

(*b*) The date of appearance of locusts or deposit of locust eggs in each barrio.

(*c*) The stage of development (eggs, hoppers, or fliers).

(*d*) The source and movements of winged swarms.

6. Whenever an outbreak of the locust pest threatens or exists, every able-bodied male inhabitant between the ages of 16 and 60 years is liable to service in the suppression of the pest. When summoned by the president of the municipality in which said outbreak occurs, or his duly authorized agent, or the person legally in charge of the locust campaign, it shall be the duty of all such inhabitants to render gratuitous service in the destruction of locusts for two days per week, working from nine and one-half to ten hours each day: *Provided,* That the locust board may, by special order, provide that such compulsory service shall

be for a period exceeding two days per week. Said inhabitants are liable to service in any part of the municipality where locusts may exist and shall work en masse or in such force and in such manner as may be deemed most efficacious to the end in view by the person duly authorized to take charge of the campaign as provided in paragraph four of these regulations.

7. It shall be the duty of all owners, tenants, or persons in charge of estates or parcels of land invaded by locusts to—

(*a*) Immediately report the presence of the locusts to the municipal president, councilor for the district, or lieutenant of the barrio infested, or to any other duly authorized officer.

(*b*) Use every possible means at his disposal to destroy said insects on his property and to prevent the propagation and spread of the pest to adjoining lands.

(*c*) Advise the owners, tenants, or persons in charge of adjacent lands of the existence of the pest and invite them to coöperate in the suppression of the same.

8. All persons not exempted by Act No. 834 may, when required to work in the extermination of locusts, redeem their obligation by paying to the municipal treasurer the sum of sixty centavos (₱0.60) for each day that they do not work when it is obligatory for them to do so under paragraph 6 of these regulations: *Provided*, That said assessments shall not be collected oftener than twice a week except by special order of the locust board.

9. All amounts collected under the preceding paragraph shall be deposited with the local deputy of the provincial treasurer, who will issue receipts for the same, and shall constitute a special fund to be used exclusively in the destruction of locusts in the municipality in which said assessments were collected, or more specifically for—

(*a*) The purchase of equipment for combating locusts.

(*b*) The purchase of food for the subsistence of indigent persons engaged in the extermination of locusts.

(*c*) The purchase of locust eggs at fifty centavos (₱0.50) per "ganta."

(*d*) The payment of persons who have already complied with their obligatory service and who wish to continue working in the destruction of locusts.

(*e*) The payment of traveling expenses of local officials incurred in connection with the locust campaign.

All other expenditures not herein provided for shall be made subject to the approval of the locust board and the Director of Agriculture.

10. Every person subject to service in the destruction of locusts, as above provided, who, upon being summoned by a duly authorized official to perform such service, refuses or fails to do so in the manner set forth in these regulations shall, upon conviction, be fined or imprisoned, as hereinafter provided.

11. Any person convicted of violation of any provision of these regulations shall be punished by a fine not to exceed twenty pesos (₱20), or imprisonment for a period not to exceed ten (10) days, or both, in the discretion of the justice of the peace.

12. The moneys accruing from fines for violation of Act No. 817, Act No. 2121, and of any provision of these regulations shall constitute a special fund to be used for the payment of hoppers or "loctones" turned in by such persons as have already fulfilled the requirements of the obligation imposed upon them by virtue of the provisions of paragraph 6 of these regulations. The price to be paid for such hoppers or "loctones" shall be fifty centavos (₱0.50) per "cavan."

13. Local officials, whether provincial, municipal, or barrio, shall be held responsible for the proper use and care of locust equipment furnished by the Government. Lack of care in its use and preservation or utilization of the same for purposes other than those for which it was intended, shall render the responsible official liable to severe administrative discipline.

14. For the purpose of these regulations, the term locust shall include all species and forms of *Acridoidea,* or short-horned grasshoppers, locally known as "loctones," "saltones," or "langostas," which congregate in swarms, as well as any other members of this family that may from time to time appear in such numbers as to be a menace to our agricultural interests.

Immediately after receipt of a copy hereof, locust boards shall hold a meeting for the purpose of considering the adoption of the foregoing proposed regulations.

LOCUST BOARDS.

Provincial board should, whenever possible, include the senior inspector of Constabulary and the superintendent of schools among the four persons recommended by it for appointment as members of the locust board by the Director of Agriculture under the provisions of Act No. 2121.

It shall be the duty of the locust board to enforce the provisions of the Acts relating to the extermination of locusts and the regulations prescribed by it and approved by the Director of Agriculture. Said board shall perform its labors either directly or through the municipal officers of the various municipalities.

In this connection, the Chief of Constabulary is directed to order his forces to aid the local authorities in the enforcement of the locust laws and of the orders and regulations promulgated or which may be promulgated by the locust board, and report on the degree of compliance with existing laws, orders, and regulations.

INFORMATION.

The Director of Agriculture shall exercise general supervision of the locust campaign throughout the Philippine Islands and, furthermore, is charged with the duty of securing and compiling information pertaining to the existence of locusts—fliers and hoppers—and locust-egg deposits in the Philippine Islands.

The Chief of Constabulary and the Directors of Education, Lands, Forestry, and Posts are directed to coöperate with the Director of Agriculture and shall, upon request, furnish him with such pertinent information concerning locusts as he may desire to have.

The locust pest may be controlled and suppressed effectively only through concerted and conscientious effort and faithful compliance with the locust laws, orders, and regulations. All persons concerned are therefore hereby enjoined to take active part in the locust-extermination campaign, adopting all possible means, in conjunction with others, to suppress the pest or prevent the propagation and spread thereof, and faithfully to observe the locust laws, orders and regulations.

FRANCIS BURTON HARRISON,
Governor-General.

HEAD-TO-THE-ROW TEST WITH RICE.

By H. O. JACOBSON, *Chief, Division of Agronomy.*

The field testing of rice varieties has been carried on by this Bureau since 1909 and upon the completion of the work during the fiscal year of 1912 it was noted that only a very limited number of varieties had maintained a uniform high degree of productivity and that the maximum point of production was unsatisfactorily low. A considerable number of varieties had produced one maximum crop, a few had produced two such, but less than ten per cent of the total number maintained their relative position season after season, and of these several had undesirable characteristics which necessitated their ultimate elimination.

One feature of the variety testing constantly encountered was the mixed condition of the seed samples secured. For instance, a sample would be submitted under a well-known local variety name, which could be graded off-hand into a number of classes, but even when these apparent admixtures were eliminated, the field test further brought out the fact that, although the grains of each sample were exceedingly similar, when sown the resultant crop was still a mixture.

Collective seed selection with the view of purifying each variety was immediately begun upon its introduction into the test, but without very encouraging results either in the direction of increased production or of uniformity in important characteristics.

Although this Archipelago has a great wealth of varieties, yet a sufficiently large number had already been handled to indicate that a different method would have to be adopted in order to secure the desired results.

It was, therefore, resolved to make a preliminary test, comparing individuals contained *within one variety.*

From the regular-season crop of 1912 several thousand heads were carefully selected, from which a second selection was made by means of simple laboratory methods.

The final collection consisted of about 1,200 heads representing 12 well-known varieties.

Every effort was made to have all the heads of each variety as nearly identical as possible.

Several precautions were observed to absolutely eliminate all red-cuticled kernels.

The seed bed was prepared in the usual manner, and the grains from each individual head were scattered within a small bamboo frame (10 by 10 centimeters), which was placed upon the surface of the seed bed. (Plate I.)

Each little seed-containing frame was numbered with the record number given the respective head.

The sowing of the propagating or nursery beds required three days, June 18 to 20, inclusive.

The first variation noticed became apparent within ten days after the seed was sown and when the plants were set out measurements were taken of the height attained by each lot.

Table I shows the range and frequency of height at that time, one month after sowing:

TABLE I.—*Seedlings at transplanting time, classified according to height, showing the number of rows of each variety in each class.*

Height.	Permanent No.									
	635.	530.	61.	813.	663.	749.	692.	447.	527.	225.
Cm.										
28	-------	-------	-------	-------	-------	-------	-------	1	-------	-------
36	-------	-------	1	-------	-------	-------	-------	-------	-------	1
38	-------	-------	1	-------	-------	-------	-------	-------	-------	-------
39	-------	-------	-------	2	-------	-------	1	1	-------	-------
40	-------	-------	1	-------	-------	-------	1	1	-------	-------
41	-------	-------	-------	3	1	-------	-------	-------	1	1
42	-------	-------	1	8	2	-------	1	-------	-------	-------
43	-------	-------	1	1	-------	-------	-------	1	-------	4
44	-------	-------	4	6	2	-------	3	1	-------	1
45	1	-------	2	2	1	1	2	-------	1	6
46	3	2	7	10	2	2	-------	5	5	7
47	3	2	4	4	2	2	-------	5	6	7
48	5	6	12	8	5	4	8	10	13	8
49	3	1	11	11	7	-------	2	4	4	1
50	10	2	19	6	7	10	7	10	14	8
51	6	2	8	7	10	7	4	9	8	1
52	20	5	12	15	7	6	5	10	15	5
53	6	2	8	5	19	9	4	4	5	-------
54	12	9	4	1	10	15	7	10	10	-------
55	3	6	-------	1	7	9	3	2	2	-------
56	11	20	3	6	7	11	1	7	8	-------
57	4	6	-------	2	4	3	-------	-------	2	-------
58	6	12	1	1	5	10	1	8	4	-------
59	1	6	-------	-------	-------	3	-------	2	1	-------
60	4	6	-------	1	1	2	-------	6	-------	-------
61	0	1	-------	-------	1	-------	-------	-------	-------	-------
62	1	7	-------	-------	-------	1	-------	-------	-------	-------
63	-------	-------	-------	-------	-------	-------	-------	-------	1	-------
64	1	-------	-------	-------	-------	-------	-------	-------	-------	-------
66	-------	1	-------	-------	-------	-------	-------	-------	-------	-------

Owing to accidents 112 lots of seed were eliminated, which accounts for incomplete figures in five of the above columns.

It should also be noted that all these seedlings were grown within the confines of one paddy.

Because of the dimensions of the paddies it became necessary in most cases to transplant the variety seed lots in two paddies.

The seedlings were removed in turn according to number and transplanted into rows, one plant to the hill, spacing the hills 20 centimeters in each direction.

Considerable variation in germination was noticeable within each variety, and a relative characteristic—vitality—was subject to as much or more variation after transplanting had taken place.

For instance, in variety No. 635, only the plants from five heads showed marked vitality after being transplanted, the remainder being relatively satisfactory in this respect, and none could be characterized as being unusually deficient.

With the exception of differences in intensity of color, size of leaves, position of leaves, and rate of growth, no important variations were recorded until after the nodes had appeared. A new feature was then encountered, namely, color variation in the stalks and auricles. Among the progeny of one head were found, for example, reddish-brown stalks with white auricles, white stalks with reddish-brown auricles, while the normal condition would be white stalks with white auricles.

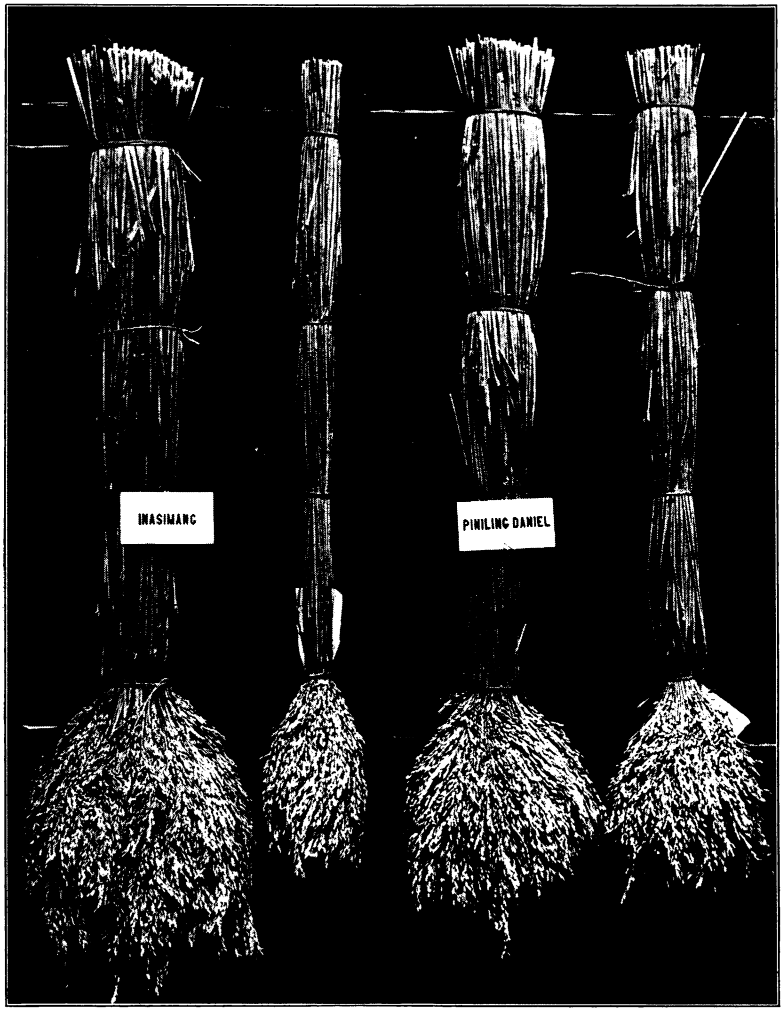
In other cases, this color deviation would be found running uniformly throughout the entire progeny of one head.

This color variation was not accepted as being a true variation, but was attributed to the influence of foreign seeds previously introduced into the variety, which had great similarity to it in all other respects. It is also probable that these variations were due to accidental hybridization. Nevertheless, a comparatively unimportant feature such as this clearly indicates the difficulties encountered in an attempt to purify a variety by collective seed selection.

Of considerable importance to the rice grower is uniformity in the maturing of the crop.

It was noted at the time when the varieties were heading out that varieties Nos. 692 and 225 headed out very evenly, requiring but three days for this period of development, while variety No. 813 required ten days to complete this stage. Other varieties were intermediate.

This feature was not wholly correlative to the maturity period as will be seen in Table II where variety No. 813 is shown to have ripened within three days.



Extreme variation in productivity—two varieties of rice. Each bundle is the crop produced by 100 plants, progeny of single heads.

(*a*) Variation in production within a variety.

(*b*) Extreme variation in production—three varieties.

TABLE II.—*Number of days to maturity and number of rows of each variety maturing in each period.*

Days to maturity.	Permanent No.									
	530.	663.	635.	61.	813.	749.	447.	692.	527.	225.
126	15									
127	49									
128	32									
130		1								
131		13								
132		33								
133		32								
134		21	19							
135			15							
136			6							
137			26							
138			34							
141				10						
142				44	21					
143				45	41					
144				1	38					
153						12				
154						24				
155						31				
156						14				
157						14				
170							14			
171							31			
172							35			
173							17			
177								18		
178								18		
179								14	19	
180									34	
181									31	
182									16	
186										17
187										17
188										16

The position of the plants at harvest time bears a direct relation to the expense of saving the crop and in this feaure individualism was clearly shown. Table III is self-explanatory.

TABLE III.—*Position of rows at maturity.*

Field No.	Permanent No.	Number of rows.		
		Erect.	Reclining.	Down.
1	635	67	31	2
2	530	40	31	24
3	61	60	34	6
4	813	76	23	1
5	663	72	27	1
7	749	64	30	0
8	692	15	19	16
9	447	33	25	39
10	527	34	41	25
12	225	0	17	33

While observations were taken and recorded on 27 variable characteristics of the individuals within each variety, the examples quoted above are considered sufficiently representative of the range of difference prevailing, but of the greatest importance was the variation in yield of grain. (See Table IV.)

TABLE IV.—*Yields of grain per 100 plants, classified according to rate of yield, showing the number of rows of each variety in each class.*

Permanent No.	Kilograms.										
	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95	1.05	1.15
749	1	1	1	1	5	8	14	14	17	11	8
61	------	1	0	8	24	22	22	8	10	2	------
530	------	------	1	0	1	2	7	17	18	9	9
635	------	------	------	------	3	5	6	13	18	7	12
663	------	------	------	------	7	10	15	26	9	11	8
692	------	------	------	------	1	2	7	5	4	6	6
527	------	------	------	------	2	1	15	12	18	17	12
813	------	------	------	------	------	4	8	7	15	20	18
447	------	------	------	------	------	2	3	4	14	14	12
225	------	------	------	------	------	------	5	3	6	6	5

Permanent No.	Kilograms.									
	1.25	1.35	1.45	1.55	1.65	1.75	1.85	2.05	2.35	2.65
749	3	2	1	1	1	------	------	------	------	------
530	3	2	------	------	------	------	------	------	------	------
635	8	5	8	2	2	1	0	1	------	------
663	3	4	2	1	------	1	0	1	------	------
692	5	2	6	1	1	------	------	------	------	------
527	6	2	0	1	1	------	------	------	------	------
813	9	8	2	1	0	2	0	0	0	1
447	12	9	7	3	2	1	5	0	1	------
225	2	2	------	------	------	------	------	------	------	------

One hundred plants occupied an area of 4 square meters or 1/2500 part of 1 hectare.

The lowest yield obtained was therefore 375 kilograms, or 8.7 cavans, of paddy or rough rice per hectare. The greatest production was 6,625 kilograms, or 154 cavans.

Naturally, when planting only one plant to the hill, the maximum yield per unit of area of ground was not obtained (as we have determined by other experiments), but the important fact is clearly indicated that the potential capacity to produce seed is highly individualistic.

It is the writer's belief that the above yield record is fairly representative of the range which may be found within very many rice varieties. In fact, it appears conservative when due consideration is given to the preliminary work which had been performed.

The environmental conditions affecting lowland rice are extraordinarily uniform, when compared with those affecting other cereals, and there appears to be no good reason for believing that this class of plants should be less stable in their individual characteristics than others.

Granting this assumption, a field for improvement of tremendous magnitude and value is opened up by following these simple lines.

If acknowledged biological laws are recognized, increased production should follow the selection of higher producing individuals for propagation.

The practicability of any propagation method is of prime importance, and referring to the table on yields one sample may be selected for demonstration.

Assuming that one of the heads yielding 1.05 kilos has a sufficient number of good qualities to render its normal yield acceptable, the entire quantity may be planted during the succeeding season.

This amount is ample for planting 1/40 hectare, and the resulting crop, at the same rate of production, will amount to 1½ cavans, in round numbers.

That quantity will, when again planted the third year, yield a crop of 90 cavans.

In actual practice, however, one would naturally select a strain producing at least twice as much; therefore, the rate of increase would be greatly accelerated, thus providing a safe margin for losses by various causes.

Where the landowner does not cultivate more than 100 hectares it is easily possible for him to provide pedigreed seed for the entire area in three, or at most four, years.

The writer has used this method of seed selection in practical farm operation with satisfactory results.

This method has also been found to be far superior to any other for the purpose of eliminating red rice.

PROGRESS IN THE ORGANIZATION OF PROVINCIAL AGRICULTURAL SOCIETIES.

By MACK CRETCHER.

The work of organizing the provincial agricultural societies progressed very satisfactorily during the month of July. During this time 12 provinces of central Luzon were visited by the organizers and a provincial society established in each province visited. The meetings were well attended, ranging from an attendance of 70 at Cavite to over 400 at Dagupan, Pangasinan. In every instance, good men were elected as officials of these provincial societies, and they at once took up the work of organizing, in their respective provinces, branch or municipal societies in the several municipalities. There has been a spirit of enthusiasm everywhere over the proposed agricultural organization, a willingness to coöperate, a knowledge of the present condition of the farmers, and a sincere desire to coöperate in any movement that promises improvement.

In the organization of these 12 provincial societies due care has been taken to outline definitely the plans and purposes of the society, and the assurance has been given that much of the success of the movement would rest with the farmers themselves. After having traveled over the 12 provinces extending from Batangas and Tayabas to Nueva Ecija and Pangasinan, and having talked to over 2,000 farmers in that territory, not only talked to them but having heard at first hand of their condition, their difficulties, and needs, the following statements are made. There is no desire to inject a single personal opinion of the writer in the following resumé of the conditions found. At every meeting where a society was formed, this question was asked and discussed immediately after organization.

"What do you think such an organization as is proposed can do for the farmers of these Islands?"

The answers were varied as was to be expected; but from an accurate stenographer's report of each meeting a summary shows the opinions in about the following order:

First. Through coöperation and united effort some equitable system of rural credit could be secured. The need of this has been repeated time and again.

Second. That through organization the farmers could come into closer contact with the Bureau of Agriculture. The Bureau would thus become better acquainted with the needs of the agriculturists and thereby extend its field of usefulness in a very practical manner.

Third. In the matter of planting crops, seed selection, and cultivation, new ideas could be secured that would materially increase production. Coöperation would be of great benefit not only in production, but likewise in marketing.

Fourth. That organization would teach farmers to depend more on themselves, the exchange of ideas and the coöperative effort and mutual understanding tending to increase confidence.

Fifth. That in the establishment of sugar centrals, irrigation projects, and mutual insurance for crops and live stock, the coöperative idea might be of material aid in solving the problem.

Sixth. A standard product could be maintained in many lines, especially in the production of copra. There is a strong desire for a classification for first, second, and third grades, with corresponding prices, thus giving an incentive for production of the better grades.

Seventh. The establishment of experimental stations in every province and a law compelling attendance of schoolboys at one of these stations every Saturday so that the students might obtain a practical idea of modern farming methods.

Eighth. The amending of the immigration laws, also the suggestion that the time of school vacations be changed so that students could work in the fields when most needed.

Ninth. Better transportation for isolated communities.

Tenth. An extension of the cadastral law.

Eleventh. The establishment of banks throughout the Islands.

Twelfth. A better understanding between the farmers and laborers.

There are many other answers and suggestions as to how coöperation may be made to help the farmers of the Islands, but enough have been given here to show that among the farmers who have attended these meetings there is a pretty fair idea of the possibilities of the organization. The organizers have been careful to state clearly that results must not be expected too soon, and that it will take time to perfect the organization thoroughly and get things in working order.

During August the organizers visited the southern provinces, carrying forward the work of organizing provincial agricultural societies in each province. Their itinerary included a visit to every southern province except the extreme southern provinces of the Island of Mindanao. The completion of this work will leave only a few provinces yet unorganized, those of the extreme northern part of Luzon, which cannot be reached until after the rainy season. As a result of the work in central Luzon and throughout the southern islands to date, exactly 20 provinces have provincial societies in fair working order with a full quota of officers, including members of the Insular council for the various agricultural products, such as rice, sugar, corn, abacá, coconuts, etc. Even thus, however, the work can hardly be said to have been more than well started. Present plans include the extension of the work of organization into every municipality in the several provinces. Work along these lines is now in progress. Even with all this, the big work of organizing the parent body, the Insular Agricultural Society, is as yet untouched. Nevertheless, the readiness with which the plans have been met by the farmers thus far is a pretty fair indication that, although the task is a large one, there is a possibility of its accomplishment. Once organized, it will be a power for good in these Islands if properly applied. The fact that all the farmers of every degree may not be included in the organization will in no wise affect the societies' usefulness. Every farmer, no matter what his degree of intelligence or financial standing, will be given the chance to affiliate with the organization and share in any benefits that may come through coöperative effort. If only the most progressive and intelligent farmers become members, the societies here will not differ much from similar organizations in other countries, where there are always some who scoff at the efforts to organize farmers institutes and who decry the results of experimental work of state agricultural colleges and bureaus as "paper farming." In spite of this, the work of the progressive farmers there who make up the bulk of the farmers' societies goes right ahead, even to the extent of hiring county farm advisors to help them solve problems of seed selection, soil analysis, insect extermination, and so on, and if these efforts are crowned with success, as they usually are, those who have kept on the outside are not slow to profit by the well-directed efforts of their more progressive brethren. Much the same thing may be expected here.

The success of this enterprise will rest largely with the best-educated and most progressive class of farmers who are now enlisting under the banner of coöperation. The societies have been organized under a plain statement of just how the members may better help themselves by united effort in working out their own problems. They have been warned that if through indifference and neglect the organization is permitted to decline, all the preliminary work will have been wasted. They have therefore been urged to attend the meetings regularly, to keep up the interest and to spread the spirit of coöperation to every municipality and barrio, with a full realization that such a work takes time and that results will come slowly, but that in the end if they work persistently and with a firm determination the results will justify their hopes.

RECENT EXPERIMENTS IN SHIELDBUDDING TROPICAL FRUITS AT THE LAMAO EXPERIMENT STATION.

By P. J. WESTER, *Horticulturist in Charge.*

Many years ago, when the writer first became acquainted with the defects and merits of the tropical fruits, he soon realized that they would never average up to the quality and prominence attained in the world's market by those grown in the Temperate Zone until they could be propagated asexually. Of late years, in making the acquaintance of many new species and with the opportunity to examine plants of the same species from many widely separated regions, the urgent need of more knowledge relative to vegetative means of propagation of the tropical exogenous fruits has been repeatedly demonstrated. For instance, in the discovery of fruits such as a mangosteen of excellent quality and ripening in August; tamarinds bearings pods so sweet that they could be eaten with relish out of the hand; seedless and, even for a European, fairly well-flavored mabolos; exceptionally large, well-flavored or prolific sugarapples, soursops, and custardapples; chicos measuring 9.5 centimeters in diameter and exceptionally sweet and well-flavored; few-seeded marangs; cashews with markedly less astringency than the average fruit; exceptionally large baunos of excellent quality, etc.; the fact remains that these exceptional individuals are of no value to the community, or to the country at large in which they grow, if nothing is known relative to the methods of vegetative propagation of the species in question. Many an observant reader with an opportunity for travel has undoubtedly had the same experience in coming across isolated specimen trees markedly different from the ordinary type in one or more respects and superior to the average fruit of the same species.

When everything is taken into consideration, certainly the most pressing need of the exogenous tropical fruits to-day is their standardization and the fixation of the superior types by vegetative methods of propagation. Not until we can assemble the superior types of one or more related species can effective hybridization be begun.

As opportunity has presented itself the writer has experimented with asexual propagation of tropical fruits with more or less success both in Florida and in the Philippines, the results of which have been set forth from time to time in the REVIEW. The most recent work along this line has been with the durian (*Durio zibethinus* Lam.), hevi (*Spondias cythereæ* Sonn.), carambola (*Averrhoa carambola* L.), bilimbi (*Averrhoa bilimbi* L.), atemoya (see Vol. VII, No. 2, of this REVIEW), cherimoya (*Annona cherimolia* Mill.), and the budding of some of the cultivated citrus fruits on the calamondin (*Citrus mitis* Blanco). Excepting with the carambola, which has been budded in India for a considerable number of years, the work here considered is believed to be original and, as far as the writer is aware, no directions relative to the budding of the carambola have ever appeared in print.

These experiments, carried out during the dry season of 1913 and 1914, have shown that the durian and carambola may be readily shieldbudded with the inverted T bud. The bud wood of both species should be well beyond the tender stage, but not so old that the wood is brittle. In the carambola, bud wood so old that the petioles have dropped should not be used. In the experiments with the durian, 100 per cent of growing plants were obtained where the leaf blades of the petioles had been removed from the bud wood sometime previous to the budding so that a good leaf scar had formed after the petioles had dropped. Where this had not been done some of the buds decayed. Whether or not the petioles have been removed (as stated for the durians) from the bud wood of the carambola, seems to be a matter of no consequence. The buds of both species should be cut about 2.5 centimeters long.

The carambola and bilimbi budded on each other have so far failed in all instances, and also the budding of the bilimbi upon itself.

In the hevi, slender branches 7 to 10 millimeters in diameter with matured wood should be selected for bud wood. If the leaves still adhere cut away the leaf blades and allow the petioles to drop sufficiently in advance of the budding to permit the formation of a good leaf scar.

Only one series of buds were inserted and of these 40 per cent died from excessive flow of sap in the bud incision or from decay entering the bud through the petiole. The buds were entirely covered with waxed tape, and it seems likely that had waxed twine been used, more live buds would have resulted as this would have permitted the evaporation of the sap. The hevi is a very rapid grower and calluses quickly; the buds should, therefore, be cut large, not less than 4 centimeters long.

The atemoya takes well on the mamon and makes a fairly rapid growth, but the custardapple seems to be more congenial, and the atemoya budded on the custardapple makes an exceedingly vigorous growth and the stock imparts to it a very characteristic upright growth. (Plate IV, *d.*)

Both the cherimoya and the atemoya have been budded on the soursop with the result that the buds take well, but even with the most vigilant care in suppressing the stock sprouts, the buds make an indifferent growth and finally die. A somewhat similar behavior of the sugarapple budded on the mamon was recorded by the writer in Miami, Florida, several years ago. It may be stated here that the cherimoya can be budded on the sugarapple, custardapple, and mamon with good results.

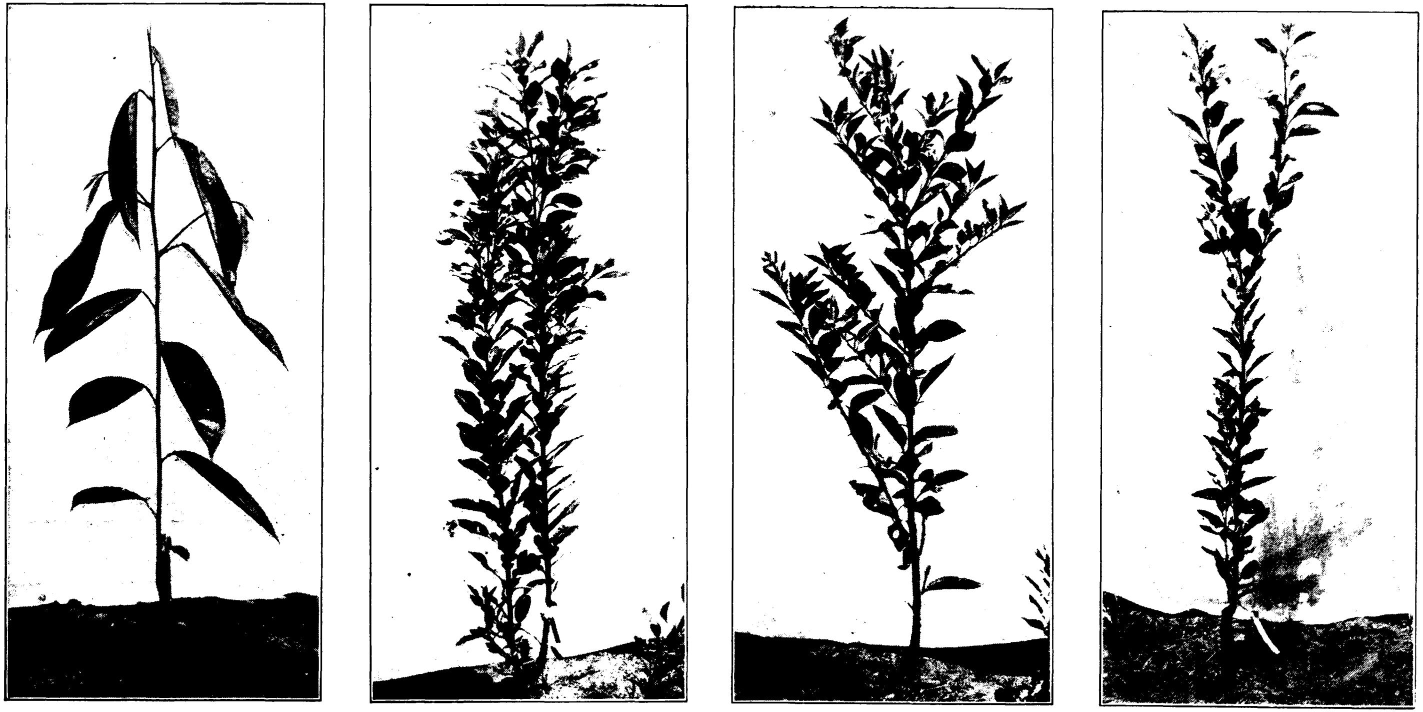
Of the Philippine citrus fruits the orange, mandarin, lime, and pomelo have taken on the calamondin without any difficulty and have made a vigorous growth. (Plate IV.)

As was anticipated, the orange and pomelo show a tendency to outgrow the calamondin when this species is utilized as a stock. Because of its weaker growth, the calamondin will in all probability dwarf the more robust species grafted upon it.

Repeated attempts to graft and bud the seedless breadfruit upon the seedling type have failed absolutely.

Bud wood of 30 varieties of avocados and 4 large-fruited guavas were received during the early part of the year from Mr. Peter Bisset, Office of Foreign Seed and Plant Introduction and Distribution, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C., and successfully inserted.

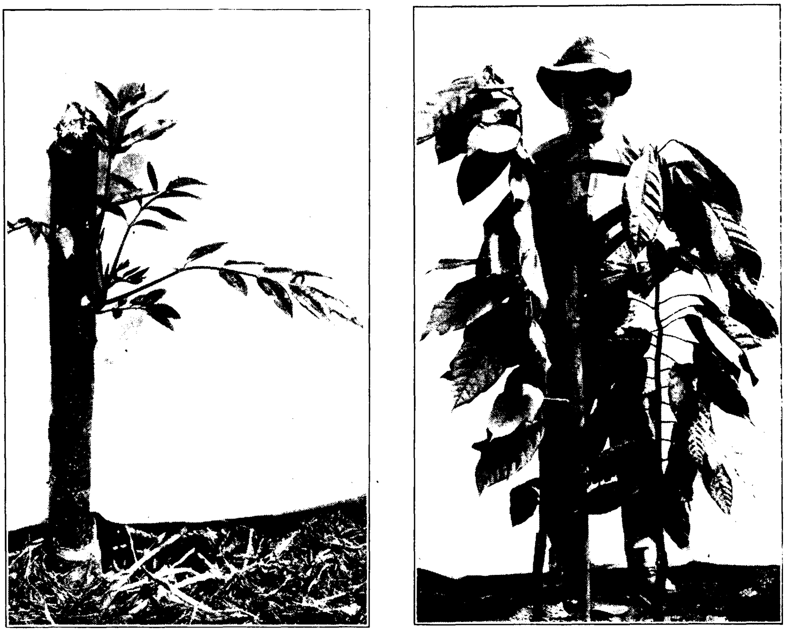
The budding of the avocado has been frequently dwelt upon in this and other publications, and the subject is now quite well known to all well-informed horticulturists in the Tropics, but the budding of the guava is practically an unknown art if we may judge by the lack of reference to it in current literature. Nevertheless the guava was authentically budded twenty years ago. MacMillan, in his "Handbook of Tropical Gardening and Planting," states that "Propagation of the tree is easily effected by seed or suckers, but budding or grafting should be resorted to for the best varieties." He does not go into details, however, nor does he speak of any budded varieties in India. The writer assembled a small collection of superior kinds at the Subtropical Garden, Miami, Florida, U. S. A., but as far as known there



(*a*) Budded durian, 1914. (*b*) Pomelo budded on calamondin, 1913. (*c*) Orange budded on calamondin, 1913. (*d*) Mandarin budded on calamondin, 1914.

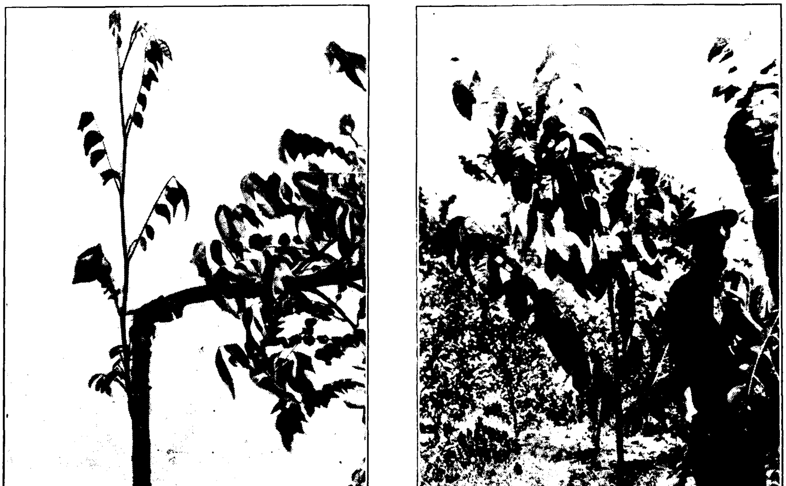
Shieldbudded plants at the Lamao experiment station.

PLATE V.



(*a*) Budded hevi, 1914.

(*b*) Shieldbudded cacao plants seven months after insertion of bud.



(*c*) Budded carambola, 1914.

(*d*) Atemoya budded on custardapple, 1913.

Shieldbudded plants at the Lamao experiment station.

are no named varieties propagated vegetatively or grown on a commercial scale.

As far as the writer knows, the earliest budding of the guava was made in 1894 in Braidentown, Florida, by Dr. H. J. Webber, now director of the Citrus Experiment Station, Riverside, California.

Unaware by this work, the writer started budding experiments during the summer of 1907 which were, however, unsuccessful. These were seen by Doctor Webber, who then related his experience, saying that the guava could be budded during the winter months, and buds were successfully inserted in December of the same year. During subsequent years guavas have been budded both by the writer and others under his direction as late as in May with good results.

In the Northern Hemisphere the budding season for the guava may be considered to extend from about November 1 to May 15. The stocks should be budded as early as their size permits, and as near the ground as convenient, for the reason that guava stocks send out "wild" sprouts more persistently than most species that have been observed, and these are apt to retard the growth of the scion if the buds are inserted too high above the ground. Inserted into old stocks the buds sprout with difficulty. The bud wood should be sufficiently mature so that all the green color of the bark has disappeared, and the buds cut 2.5 to 3 centimeters long. Waxed tape should be used for tying and the whole bud should be covered.

LIVE STOCK IN THE PHILIPPINE ISLANDS.

[Prepared by the division of statistics.]

Year ending Dec. 31—	Carabaos.	Cattle.	Horses.	Hogs.	Goats.	Sheep.
1910	756,724	269,963	142,604	1,681,550	441,455	94,166
1911	863,649	315,495	151,696	1,703,078	455,291	93,341
1912	958,512	362,230	170,861	1,888,122	475,794	98,656
1913	1,047,164	418,114	179,089	2,086,736	528,180	104,147
Increases for 1913:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent,*	*Per cent.*	*Per cent.*
Over 1910	38.38	54.88	25.58	24.10	19.65	10.60
Over 1911	21.25	32.53	18.06	22.53	16.01	11.58
Over 1912	9.25	15.43	4.82	10.52	11.01	5.57

CURRENT NOTES—SEPTEMBER.

NOTES BY H. O. JACOBSON, Chief, Division of Agronomy.

XENIA (?) IN RICE.

During the harvesting of the regular-season rice crop in 1912, while examining a head of variety No. 73, which is white, nonglutinous and bearded, two kernels were found which appeared to have a marked pinkish color. All the remaining kernels of this head were pure white.

These two kernels were planted separately and crops therefrom matured. One kernel (*a*) produced white kernels only, while the second kernel (*b*) produced nothing but red-cuticled kernels.

Each lot was again planted separately and the (*a*) lot when harvested contained 6 per cent of red-cuticled kernels. The (*b*) lot produced 24 per cent of white kernels, the remainder being red. In no case were red and white kernels found in the same head, of course.

It is plainly evident that the (*b*) kernel was a hybrid produced through cross fertilization by the pollen from some nearby red-cuticled variety.

This is the only occasion where the writer has witnessed color xenia take place in rice and the above account is submitted with the idea of inviting comment on the subject.

COMPARISON OF RICE YIELDS AT THE BUREAU STATIONS WITH THOSE OF THE PROVINCES.

In connection with certain rice investigations carried on by the Bureau of Agriculture, the behavior of varieties when removed to new localities is worthy of notice.

A table is given herewith which shows the average production of large numbers of varieties, when grown in their respective provinces and when grown on the stations of the Bureau.

The increased production on the experiment stations is credited to two or three main factors, such as moderately early planting, sufficient water supply, and fairly good preparation of seed bed. No fertilization has been given. On the other hand, all the crops produced by the Bureau have been with but one seedling to the hill. This practice, while necessary in the work for very good reasons, reacts very unfavorably on the yield. This has been proved by actual experiment.

The yields obtained by the Bureau would undoubtedly have been very much greater if any particular measures to increase them had been practiced, but all crops were grown under what is commonly termed "farmer's conditions."

Provinces.	Average production per hectare in cavans.	
	By the stations.	By the farmers.
Antique	48.26	11.33
Camarines	41.45	24.29
Capiz	44.16	17.92
Ilocos Norte	51.03	20.76
Ilocos Sur	44.36	12.85
Iloilo	21.74	14.23
Laguna	48.87	19.65
Leyte	41.41	16.13
Misamis	46.73	13.79
Moro	14.68	11.71
Nueva Ecija	47.16	43.00
Nueva Vizcaya	36.82	27.58
Occidental Negros	39.63	12.63
Oriental Negros	26.21	3.66
Pangasinan	44.96	26.39
Samar	42.90	11.95
Tarlac	45.77	24.51
Tayabas	46.46	9.20
Zambales	49.23	26.76

NOTES BY P. J. WESTER, Horticulturist in Charge of Lamao Experiment Station.

NOTES ON ANNONAS.

For many years we used to regard the cherimoya (*Annona cherimolia* Mill.) as not only the best of the annonaceous fruits, but as one of the three best of all tropical fruits. When the many South and Central American annonas and rollinias shall have been "unearthed," so to speak, the cherimoya may yet to have to look to her laurels. Not so many years ago Baker declared the biriba (*Rollinia orthopetala* A. DC.) to be the finest of all the Brazilian annonaceous fruits. The mirim (*Rollinia emarginata* Schlect.), indigenous to southern Brazil and Paraguay, has also been reported as of exceptionally good flavor by one of the correspondents of the Bureau of Agriculture. Mr. Carlos Wercklé, Department of Agriculture, San José, Costa Rica, in a recent letter to the writer states of the soncoya (*Annona purpurea* Moç. et Sesse) that the fruit is spherical, of the size of a child's head, and of a brownish-green color, each carpel being surmounted by a high peak; the pulp is orange colored and very aromatic, so much so, in fact, that a ripe fruit can be detected at a considerable distance in the forest. Its one defect seems to be that the seeds adhere to the flesh. According to Mr. Wercklé, the soncoya is superior in flavor to the cherimoya.

The biriba was first introduced into the Philippines four years ago by Mr. W. S. Lyon, and the trees have made excellent growth and may be expected to fruit another year. A second introduction of the biriba was made by the writer three years ago, the plants making good progress at the Lamao experiment station. The mirim was received two years ago from the Office of Foreign Seed and Plant Introduction, Bureau of Plant Industry, U. S. Department of Agriculture, and two plants of the soncoya were received a few weeks ago from the same source in excellent condition and are making rapid progress.

Over a year ago seeds of *Rollinia mucosa* Baill. (*Anona obtusiflora* Tuss.), (*A. mucosa* Jacq.), (*Rollinia sieberi* A. DC.) were received from Mr. G. Regnard, Mauritius, and were planted at the Lamao experiment station. In a recent letter to the Bureau Mr. Regnard states that in Mauritius this species is very prolific, and that the fruits are very large, averaging 2.25 kilograms in weight, fruits weighing 2.70 kilograms not being uncommon, the branches of bearing trees often breaking under the load of fruit. The fruit is spherical with distinct, very prominent carpels near the base, and almost flat at the apical end; the surface is pale yellow, the rind thick, and the flesh is white, transparent with an agreeable flavor, but is lacking in sweetness.

The plants grown from the seed sent by Mr. Regnard are in every respect identical with plants of the biriba obtained from Brazil, and, provided that the identification of the species is correct, there is every reason to believe that these two species are synonymous. By the same token *Annona paraguariensis* introduced last year from South America is only a synonym of *Annona reticulata* L.

Nearly all the atemoyas (hybrids between the cherimoya and the sugarapple) are bearing their maiden crop of fruits at the date of writing (July 4). There is considerable variation in the fruits exteriorally and unquestionably the flavor will vary considerably also. Successful crosses were made this spring between the atemoya and the sugarapple, utilizing either species as pollinizer; several crosses were also made between the atemoya, as the mother plant, and the custardapple, mamon, and a cherimoya, imported from Australia, reputed to bear fruits weighing 2.7 kilograms of excellent quality. The resultant fruits are now near maturity and several hundred hybrid seeds may be expected for propagation.

NEGLECTED AGRI-INDUSTRIAL OPPORTUNITIES IN THE PHILIPPINES.

Very few agricultural products are sent out by the tiller of the soil in their natural state ready for consumption or direct utilization by the ultimate consumer. Nearly all require from one to several more or less complicated processes of manufacture before they are ready to pass into the hands of the retailer. As examples may be cited the grains in the conversion into flour, starch, or other foods; sugar cane in the manufacture of sugar and molasses; and crude rubber, utilized in multitudinous ways. Fruits and vegetables are among the few exceptions to this rule though even here millions of pesos worth are annually preserved, canned or dried.

For all practical purposes all manufacturing plants that are thus employed are located in the Temperate Zone, and not only are the grains milled, the wine pressed, or the beet sugar refined where the raw material is produced, but all the important tropical products that go to make up the world's necessities and luxuries—raw sugar, crude rubber, cotton, copra, cacao, etc.—are also exported thence. The refining processes through which these and other raw material passes give employment to millions of people and the money thus put into circulation aids in the upbuilding and the maintenance of the prosperity of the countries in which the manufacturing establishments are located.

That these manufacturing plants were established in the Temperate Zone is of course self-evident, but why these regions should continue to have a monopoly of these establishments is hard to understand—if the dwellers in the Tropics took advantage of their opportunities. And, speaking now of the Philippines, if they did, our export figures would show a great increase which in turn would redound to the general prosperity of the Archipelago.

Why should we, for instance, export all our sugar in the raw state and then import all the refined sugar consumed in the Islands? There is a sugar refinery in Hongkong: Why not one in Manila? Or in Iloilo? Only an infinitesimal amount of our copra is converted to oil, yet the oil and vegetable butter manufactured from copra commands a higher price, and we could to great advantage utilize the poonac for fattening hogs and cattle, which in turn would tend to decrease our meat imports, or it could be used as a fertilizer for our plant crops.

There is also room for starch factories, preserving factories, for the canning of fruits, the manufacture of fruit sirups, fruit extracts and wines, chocolate and cocoa factories, match factories, rope factories, etc., all of which would give remunerative employment to thousands of people and add to the sum total of their well being and aid in making the Philippines more prosperous.

"AN EXPERIMENT IN MARKETING UNDER TERRITORIAL AUSPICES."

This is the title of a press bulletin by E. V. Wilcox and A. T. Longley, which has recently been issued by the Hawaii agricultural experiment station, and which is of particularly timely interest and instructive to the Filipino farmer at the present time in connection with the organization of coöperative societies.

At the 1913 session of the legislature in Hawaii an act was passed that provided funds to the amount of ₱60,000 for a period of two years, to be used in furthering the production and marketing of promising agricultural crops which had hitherto not been established on a paying basis, the expenditures of the allotment being left to the discretion of the Hawaii experiment station.

With the aid of this appropriation the Hawaii experiment station organized a territorial marketing division July 1, 1913. At the time of the writing of the press bulletin in question the work had been carried on for a period of ten months, during which time the division had received and marketed produce as follows:

July, 1913	₱606.82
August, 1913	251.12
September, 1913	524.22
October, 1913	168.10
November, 1913	1,605.06
December, 1913	3,025.64
January, 1914	3,641.64
February, 1914	2,343.22
March, 1914	8,007.36
April, 1914	11,018.84

This is a total of ₱31,192.02 for ten months. The operating expenses for the same period amounted to ₱2,981.98, or something over 9 per cent of the value of the produce marketed.

The consignments included live stock, poultry, vegetables, fruit, honey, rice, coffee, etc., with more than 150 consignments per month. There was the rather remarkable growth in the monthly transactions from ₱600 to ₱11,000 during ten months.

According to the writers, the business of the marketing division is expected to reach a total of ₱240,000 per year at the end of the next twelve months, and it is anticipated, judging from past experience, that this can be handled at a cost of 4 per cent of the value of the produce, and it is further pointed out that this annual business of ₱240,000 is largely new value, made possible by the establishment of a rational system of marketing. It seems that the experiment has been a success so far and the establisment of a retail market in Honolulu, and a branch office in San Francisco, California, are contemplated during the coming year. A similar enterprise in the Philippines would appear to be good business.

PLANT BREEDING IN SWEDEN.

Being the first extended account in English of the famous plant-breeding establishment in Svalöf, Sweden, by its director, Dr. H. Hjalmar Nilsson, the leading article in the July issue of the Journal of Heredity is of more than usual interest. As the breeding work at Svalöf has been chiefly conducted with cereals, the article should be of special interest in the Tropics to those concerned in the improvement of agronomical crops.

The foundation of the "Sveriges Utsädesförening," as the institution is called in Sweden, dates from 1886, the founders comprising farmers and agriculturists, and the aim being the improvement of the Swedish cereals. The work at Svalöf was directed by Neergaard from 1886 to 1890, since when it has been under the direction of Dr. H. Hjalmar Nilsson.

During the first years of operation "the 'methodical selection' accepted and practiced universally at that time, in direct accordance with the selection theory of Darwin, which was still recognized as the probable solution of the formation of species," was in use. In 1892 Nilsson made his epoch-making discovery of "elementary species," and in 1893 the breeding work at Svalöf was changed and carried on in line with the new principle discovered the previous year.

Since that time the breeding work at Svalöf has grown steadily in importance and volume, until in 1912 the trial grounds contained no less than 9,500 separate cultures, and in the production of an unusually large number of new and valuable cereals, legumes, forage plants and rootcrops. In some parts of Sweden the grain varieties originated at Svalöf have in various sections wholly or in part supplanted all other varieties, and every year there are larger areas planted to the Svalöf grains in Russia, Austria, France, Holland, Denmark, and England, which have also gained favor in certain parts of United States and Canada.

In Sweden the plant-breeding station in Svalöf has become one of the greatest factors in the agricultural improvement of that country, and, as the "Sveriges Utsädesförening" has become known abroad, its organization of plant breeding has been studied by most civilized countries and adapted to their special needs.

In reading the article under consideration two things stand out preëminently as contributing factors to the unparalled success attained in Svalöf: one, the fact that since the new principle of breeding became established the work has progressed without interruption under the direction of one man; and the other, that all work has proceeded with a practical aim in view, no work, time or funds being wasted on theoretical speculations, and experiments that did not have a direct practical bearing on the object.

The success achieved in Svalöf with temperate cereals, legumes, and forage plants should prove a stimulating incentive to breeders of sugar cane, rice, corn and forage plants in the Tropics.

THE JABOTICABA.

Attention has frequently been called in this publication to new or little-known Philippine or other tropical fruits and their possibilities for the plant breeder, and the value of their dissemination. The July number of the Journal of Heredity contains an interesting account by Popenoe of what is practically a new fruit from Brazil, the jaboticaba, *Myrciaria cauliflora* Berg. In fact, some authors recognize under the name "jaboticaba" two additional species, *Myrciaria jaboticaba* Berg and *M. trunciflora* Berg. The difference between these species seems to be so very slight with numerous intermediary forms that a thorough study of all will probably result in the adoption of one common species.

The description and illustrations of the plant show the jaboticaba to be quite closely related to the Philippine lipote (*Eugenia curranii* C. B. Rob.). The fruits of the jaboticaba are somewhat larger than the lipote and contain a proportionately larger amount of flesh. It should be remembered, however, that the jaboticaba has had the advantage of centuries of cultivation while the lipote is at present practically a jungle fruit. Strange to say the jaboticaba, so prominent in Brazil horticulturally, and of striking appearance, has not until very recently been introduced abroad. A rather interesting coincidence is the fact that the fruits of both the jaboticaba and the lipote are used in wine making.

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New, vigorous, and luxuriant abacá grown by the new method on the site of old and depleted plants, La Carlota Experiment Station.

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EDITORIAL.

THE STANDARDIZATION OF ABACA (MANILA HEMP).

By the DIRECTOR OF AGRICULTURE.

For a period covering more than a quarter of a century abacá has been the leading export product of the Philippine Islands. During a part of this period this one product has comprised more than two-thirds of the total value of Philippine exports.

Inasmuch as the production of abacá on a commercial scale has always been confined to the Philippine Islands, and as it has long been recognized as the premier cordage fiber of the world, the producers have enjoyed a position of unusual security. The only serious danger that has threatened the industry has been the possibility of a decrease in the demand for abacá. This situation might be brought about either by the increased production of competing fibers, or as a result of deterioration in the quality of the Philippine fiber. This possible danger has, as a matter of fact, materialized in such degree as to call for decisive and effective action on the part of the Philippine Government.

The increasing production of machine-cleaned sisal, together with the deterioration in the quality of abacá have resulted in a very considerable substitution of the former for the latter. The principal reason for this substitution has been that the manufacturers can purchase sisal knowing that they will receive fiber of a uniform quality. In the case of abacá the large number of grades and the various systems of grading and marking used by different commercial firms have created a situation which makes it difficult, if not impossible, for the manufacturer to obtain a steady supply of fiber of a uniform quality.

The obvious remedy for this condition is to establish a limited number of standard grades, and to guarantee by a system of Government inspection that all fiber exported shall conform to these grades. It was determined in 1913 to attempt the regulation of the Philippine fiber industry by establishing a system of Government standardization and inspection. A law was drafted that provided not only for standard grades and a system of inspection, but also for educational work among the planters. This law was enacted by the Third Philippine Legislature on February 28, 1914, to become effective on January 1, 1915.

Subsequent to the enactment of the Fiber Inspection Law the chief of the fiber division of the Bureau of Agriculture has conferred with the leading fiber brokers and cordage manufacturers in Great Britain and the United States. It was clearly shown in these conferences that there existed an urgent need for the regulation of the Philippine fiber industry, and very general assurance has been received that the new law will be strongly supported.

The general situation of the Philippine fiber industry, with special reference to the new Fiber Inspection Law, is discussed in detail in this number of the REVIEW.

THE PHILIPPINE AGRICULTURAL REVIEW.

The first number of the PHILIPPINE AGRICULTURAL REVIEW was published by the Bureau of Agriculture in January, 1908. This periodical has since been issued as a monthly publication for a period of seven years.

The purpose of the REVIEW has been to provide a means by which the farmers throughout the provinces might be brought more closely in touch with the work of the Bureau of Agriculture. We believe that it has not only fulfilled this purpose, but that it has also been instrumental in promoting the interests of Philippine agriculture throughout the civilized world.

The material published in the REVIEW may be divided into two general classes—that of a semitechnical nature, which is of direct interest to only a limited number of farmers in the Islands, and that which is not technical and is of special interest to the farmers. There is a demand for both of these classes of material, but there is considerable loss and waste where they are combined in one publication.

With a view of promoting both efficiency and economy it has been decided to publish the REVIEW as a quarterly, in English only, and to issue for free distribution a monthly publication, "The Philippine Farmer," published both in English and Spanish.

This change in policy will eliminate the distribution of a large amount of printed matter to persons who are not making the best possible use of this material. It will, also, enable the Bureau to make a more general free distribution to the farmers of the Islands of elementary material, for which there is a large and constantly increasing demand.

FIBER INSPECTION LAW.

THIRD PHILIPPINE LEGISLATURE, *Special Session of 1914.* — C. B. No. 154.

[No. 2380.]

AN ACT PROVIDING FOR THE INSPECTION, GRADING, AND BALING OF ABACA (MANILA HEMP), MAGUEY (CANTALA), SISAL, AND OTHER FIBERS.

By authority of the United States, be it enacted by the Philippine Legislature, that:

SECTION 1. For the purpose of this Act the terms herein used are defined as follows:

(*a*) "Fiber" is used with reference to its common and commercial significance and not to its scientific meaning. In this Act this term shall mean the raw material only, and not fibers partially or entirely manufactured.

(*b*) "Abacá" shall mean the fiber of the plant of the same name, which is known technically as *Musa textilis* and commercially as "manila hemp," "manila," and "hemp."

(*c*) "Maguey" (cantala) shall mean the fiber of the plant of the same name, which is known technically as *Agave cantala* Roxb., and commercially as "maguey," "manila maguey," and "Philippine maguey."

(*d*) "Sisal" shall mean the fiber of the true sisal plant, *Agave sisalana* Per., which is sometimes known locally as "maguey de Hawaii."

(*e*) "Strand" shall mean several fibers twisted together by hand for tying bundles or hanks.

(*f*) "String" shall mean a handmade rope or strand of abacá, maguey, or sisal which has been used for tying several bundles or hanks together.

(*g*) "Tow" shall mean pieces of broken fiber or fine fibers, interwoven in such a way as to break wholly or in part during the operation of carding at the mill.

(*h*) "Waste" shall mean the broken fiber or partially cleaned fiber strips which fall under the knife or machine during the operation of fiber extraction.

(*i*) "Grading station" shall mean any city or town which shall be designated by the Director of Agriculture as a place where the grading and baling of abacá, maguey, or sisal may be practiced. Such a station may have one or more grading establishments.

(*j*) "Grading establishments" shall mean a building or group of buildings at a grading station where the grading, baling, and preparation for export of abacá, maguey, and sisal fibers are authorized in accordance with the provisions of this Act. The owner of such an establishment may be an individual, an association, or a corporation.

SEC. 2. (*a*) The Director of Agriculture is hereby enjoined and directed to establish, define, and designate standards for the commercial grades of abacá, maguey, and sisal, which shall become the official standards of classification throughout the Philippine Islands, calling to his assistance the agencies of his Bureau, those of any other Bureau or branch of this Government, or such other agencies as he may deem necessary.

(*b*) The Director of Agriculture shall prepare in suitable form the official standard of each grade of the fibers covered by this Act and furnish the same upon request to all authorized grading establishments, provincial governments, chambers of commerce, planters' associations, and other institutions directly interested in the trade, the actual cost of such specimens to be paid in advance by the party requesting the same.

(*c*) The designation and mark of each grade of the official standard, together with the basis upon which each grade is determined, shall be defined and published by the Director of Agriculture in a Bureau of Agriculture General Order not less than six months prior to the date when this Act goes into effect; the Director of Agriculture shall furnish a sufficient number of copies of this order and of any other or others hereafter issued on this subject to the foreign markets, municipal presidents, provincial governors, and to such other persons and corporations as he may deem advisable, for general information and guidance.

(*d*) To preserve the official standards as originally prepared, the Director of Agriculture shall stipulate the manner in which they shall be kept and shall define the period at the expiration of which they shall be renewed.

(*e*) Any grading establishment shall have the right to prepare or renew the set of official standards of grades for its use, providing that such a set shall be an exact copy of the official set of standards and that it shall have been approved and certified to by the Director of Agriculture or his authorized agent.

(*f*) The Director of Agriculture shall establish one or several standards for abacá which may have been partially cleaned or prepared in the form of tow, waste, or strings, at the request of a party concerned, if such standards are required by the market. He shall also likewise establish a standard or standards for the fiber of any species of *Musa* other than abacá for which there shall be a demand in the market. Such standards, if established, shall be designated and defined in the general order referred to in section two (*c*) of this Act.

SEC. 3. (*a*) Six months prior to the date on which this Act goes into effect, the Director of Agriculture shall organize in the ports of export the offices in which the grading of abacá, maguey, sisal, and other fibers shall be practiced. He shall likewise organize identical offices at the request of a party concerned at any point in the Archipelago.

(*b*) No person, association, or corporation shall engage in grading abacá, maguey, or sisal, unless a permit shall have previously been obtained, which shall be signed by the Director of Agriculture, such permits to be known as "grading permits."

(*c*) There shall be six classes of grading establishments which shall be classified (according to the quality of loose fiber they grade and bale per annum) as follows: First-class establishments, handling five thousand metric tons and above; second-class establishments, handling between two thousand five hundred and five thousand metric tons; third-class establishments, handling between two thousand and two thousand five hundred metric tons; fourth-class establishments, handling between one thousand and two thousand metric tons; fifth-class establishments, handling between five hundred and one thousand metric tons; and sixth-class establishments, handling less than five hundred metric tons.

(*d*) Grading permits shall be furnished to any grading establishment the owner or owners of which shall prove to the Director of Agriculture that they possess the necessary qualifications to carry on the work, and on payment in advance of an annual fee of one thousand pesos for first class, five hundred pesos for second class, two hundred and fifty pesos for third class, one hundred pesos for fourth class, fifty pesos for fifth class, and twenty-five pesos for sixth class establishments. The classification of grading establishments shall be based on the quantity of fiber graded and baled during the year previous to the one for which a grading permit is desired. In the case of a new establishment, the classification shall be made at the end of the first year and it shall pay the fee corresponding to such year.

(*e*) In grading fiber for export, each grade prepared shall correspond to one of the official standards, and it shall also bear the same designation and mark as the latter. The set of official standards shall be placed in a prominent position in the grading shed for reference.

SEC. 4. (*a*) Every grading establishment which is also an exporter of the fiber shall have the right to use private marks, or brands, in connection with the name of the official standard, providing that such marks shall have been previously registered at the office of the Director of Agriculture and their use authorized by the said official, and also providing that each mark shall constantly refer to the same official standard or a specified type thereof. Application forms for the registration of private marks can be obtained free of charge from the Director of Agriculture.

(*b*) The Director of Agriculture may, after giving the grading establishment one month's notice in writing, cancel the brand or brands of any grading establishment when it shall have been proved that such brand or brands have not been constant or if their use shall have led to mistakes or confusion. The order of cancellation shall take effect immediately, without prejudice to carrying the matter in appeal to the Secretary of Public Instruction, who, in the case of a decision adverse to the Director of Agriculture, shall order that the brand or brands canceled be restored.

SEC. 5. (*a*) All fibers included in this Act which are intended for export shall be pressed in bales approximately of the following dimensions and weight: Length, one meter; width, fifty centimeters; height, fifty-five centimeters; and weight, one hundred and twenty-five kilos, net. In any grade of abacá in which the quality of the fiber may be injured by excessive pressure, the approximate dimensions and weight of each bale of such fiber shall be determined in a general order by the Director of Agriculture.

(*b*) The limit of size of diameter of each hank contained in the bale of abacá, the manner in which these hanks shall be arranged in the bale, and the manner of labeling and tying of each entire bale shall be designated by the Director of Agriculture not later than six months prior to the date on which this Act goes into effect.

(*c*) Each and all hanks of fiber contained in a bale shall be uniform in quality, and each hank shall also be securely tied by a strand to hold the hank together, and which shall be identical with the fiber which constitutes the bale.

(*d*) Every bale of fiber shall be free from strings, waste, tow, damaged fiber, fiber not identical with that which constitutes the bale, or any extraneous matter, and the fiber shall be thoroughly dry.

(*e*) No authorized grading establishment shall be permitted to charge a fee exceeding eight pesos per metric ton for baling and grading any fiber which is included in this Act.

SEC. 6. (*a*) In order to enable him to supervise the grading and baling of abacá, maguey, and sisal at the various grading stations in the Philippine Islands and to see that the provisions of this Act are adhered to by all authorized grading establishments, the Director of Agriculture is hereby authorized and directed to organize a special subdivision to be known as the "fiber inspection subdivision," which shall be subsidiary to the fiber division of the Bureau of Agriculture.

(*b*) The chief of the fiber division of the Bureau of Agriculture shall be chief fiber inspector, and shall receive compensation therefor in addition to his salary of not to exceed two thousand pesos per annum.

(*c*) The force of the fiber inspection subdivision shall consist of employees to be known as fiber inspectors, one or more of whom shall be stationed at each export port and at such other grading stations as the Director of Agriculture may deem necessary, upon the request of the party or parties concerned. The duty of such inspectors shall be to make a periodical inspection of all grading establishments within their jurisdiction, to inspect all graded and baled abacá, maguey, sisal, and such other fibers as are included in this Act, which are intended for export, to collect all fees of inspection, and to issue to the shipper or owner of the fiber a certificate or certificates to be known as "certificates of inspection" which shall set forth the result of their inspection by showing the total number of bales inspected by them for each shipper or owner, the number of such bales of each grade and mark (if any), and such other additional data as may be stipulated by the Director of Agriculture.

(*d*) A certain number of fiber inspectors shall be detailed from time to time for educational work among the fiber producers in any district in the Philippine Islands, whose duty shall be to instruct the latter as to the manner in which they should prepare their product so as to meet the requirements of this Act, and to give them such other information as will enable them to understand the grade or grades of fibers they prepare and the current prices therefor.

(*e*) Fiber inspectors shall receive a compensation of not to exceed four thousand pesos per annum. Only persons who shall have had experience in the classification of abacá and other fibers during a period of not less than four years or who shall have acquired sufficient instruction in agricultural matters may be appointed fiber inspectors.

(*f*) The Director of Agriculture or his authorized agent shall maintain an office at as many grading stations as there are ports of export for abacá and other fibers and at such other grading stations as he may deem necessary at the request of the parties concerned, and at each such station one or more inspectors shall be stationed, and shall provide each such office with such supplies, instruments, and other equipment as may be required to carry on the work of inspection in an efficient manner.

(*g*) All fiber of which the official standard shall have been established as provided in section two hereof shall be graded, baled, inspected and approved as provided in this Act.

(*h*) A grading establishment shall give the fiber inspector four days' notice in writing when practicable, stating the number of bales ready for inspection, and, when practicable, the name of the steamer on which same is to be shipped, and the destination of the shipment.

(*i*) Inspections shall be made in the regular grading shed, where one bale of every twenty, and such additional bales as they may deem necessary, shall be opened by the fiber inspectors for a thorough examination: *Provided,* That in case of the receipt of a shipment of fiber which has been graded and baled but not inspected, inspection of any such shipment shall be made at such place as he may designate, and the owner of such fiber shall provide for the transportation of the bales to be inspected to and from the place of inspection.

The object of such inspection shall be to determine whether or not the grade inspected conforms with the official standard for the same, whether or not the private mark (if any) used is correct, and whether the baling and labeling is in conformity with the provisions of this Act and the authorized instructions of the Director of Agriculture.

(*j*) The fiber inspector shall have free access to the grading and baling sheds; and also to the warehouses where the bales are stored, of any grading establishment within his jurisdiction, during working hours, to make an inspection, for the purpose of satisfying himself as to the propriety of the methods used therein. He shall also see that the approved set of official standards is always carefully preserved and renewed within the specified period.

(*k*) Every shipment of graded and baled abacá, maguey, or sisal, which has been inspected and approved, shall be accompanied by a certificate or certificates of inspection attached to the bill of lading and duly signed by the fiber inspector who made the inspection. All certificates of grading shall be prepared in quadruplicate, the original and one copy to be given the owner, one copy to be forwarded to the Director of Agriculture, and one copy to be filed in the inspector's office.

(*l*) When a lot of fiber, which has been graded, baled, and duly inspected and approved, is transferred by sale or otherwise from one owner to another, the certificate of inspection shall accompany the lot and the transfer of ownership noted thereon by the fiber inspector in the locality where the transfer has taken place. If, however, a new certificate is desired by the purchaser, the same shall be issued to him by the local fiber inspector. Such a certificate, however, shall be known as "secondary certificate of inspection."

(*m*) Fiber which has been duly inspected, graded, baled, and shipped from one port to another in the Philippine Islands shall not be subject to further inspection at the port of destination, except upon written complaint received by the chief fiber inspector, providing that during transit the bales shall not have been exposed to moisture or any other agency which is likely to impair their quality.

(*n*) Ten centavos shall be charged and collected by the appropriate fiber inspector for each bale of fiber inspected and stamped by him, whether approved or rejected. Such charges shall be paid by the owner of the fiber and a receipt therefor shall be given him.

(*o*) Any person, association, or corporation purchasing graded, baled, and inspected fiber for manufacture in the Philippine Islands into yarn, twine, rope, or other articles shall be refunded the inspection fee hereinbefore provided for upon presentation to the Director of Agriculture of the certificate of inspection covering the number of bales consumed in such manufacture, together with an affidavit that said number of bales has actually been consumed in such manufacture within the Islands.

SEC. 7. (*a*) No person shall change, obliterate, or counterfeit, wholly or in part, or cause to be changed, obliterated, or counterfeited, the official or private mark or brand on any bale of fiber which has been inspected, graded, and stamped as provided in this Act, nor shall any person use any tag or mark which is not in accordance with the provisions of this Act or the authorized orders of the Director of Agriculture; nor shall any person tamper with or alter the quantity or quality of any bale of fiber which has been inspected, graded, and stamped as provided in this Act.

(*b*) Any person, association, or corporation violating any of the provisions of this Act shall, upon conviction thereof by a court of competent jurisdiction, be fined not more than two hundred and fifty pesos.

(*c*) Upon conviction of any person, association, or corporation of a violation of any of the provisions of this Act, the Director of Agriculture may withdraw and cancel the grading permit theretofore issued to such person, association, or corporation.

SEC. 8. All acts of the Director of Agriculture authorized by this Act shall be previously submitted to the Secretary of Public Instruction for his approval.

SEC. 9. This Act shall take effect on the first day of January, nineteen hundred and fifteen.

Enacted, February 28, 1914.

GRADING AND BALING PHILIPPINE FIBERS.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE.

MANILA, P. I., *July 10, 1914.*

GENERAL ORDER
No. 33.

From and after the above date, and until further orders, the provisions, requirements, and regulations of General Order No. 32, of the Bureau of Agriculture, dated Manila, June 30, 1914, shall be and are hereby amended to read as follows:

In accordance with the provisions of Act 2380 of the Philippine Legislature, entitled "An Act providing for the inspection, grading, and baling of abacá (Manila hemp), maguey (cantala), sisal, and other fibers," the following regulations, governing certain phases of the grading and baling operations of Philippine fibers, are hereby issued for the information and guidance of all concerned:

These regulations cover three main subjects, namely, (1) designation of the official standard grades for each fiber included in Act No. 2380; (2) determination of the standard grades and types thereof; and (3) additional regulations regarding baling and labeling.

I. *Designation of official standard grades.*

The following-named Philippine fibers are included under these regulations, and a separate set of standard grades are established for each:

(1) Abacá (Manila hemp)—Well-cleaned fiber.
(2) Abacá (Manila hemp) strips—Partially cleaned fiber.
(3) Maguey and sisal—Retted.
(4) Maguey and sisal—Knife or machine cleaned.
(5) Pacol, or wild banana.

1. *Abacá (Manila hemp)—Well-cleaned fiber.*—The following grades shall be the official standard of classification for this fiber only when the product is in the form of fiber, i. e., well cleaned:

Letter designation.	Name of grade.	Approximate equivalent.
A	Extra prime	F. E. A. quality
B	Prime	F. E. B. quality
C	Superior current	50 per cent over good current.
D	Good current	Good current.
E	Midway	Midway.
F	Current	Current.
G	Seconds	Superior, good, and fair seconds.
H	Brown	Good brown and brown (red).
	Damaged	

To the above grades will be added "strings" and "tow," which shall stand on their merits without further division into grades.

2. *Abacá (Manila hemp) strips—Partially cleaned fiber.*—The term "strips" shall apply to the partially cleaned fiber, and therefore the following set of standards replaces what has heretofore been known as "U. K." grades, "Daet current," and other inferior grades of a "coarse" nature.

Name of grade.	Approximate equivalent.
Fair	Current U. K. and superior seconds U. K.
Medium	"Coarse" seconds and "coarse" brown.
Coarse	Daet current and seconds.
Coarse brown	Daet reds.

3. *Maguey and sisal—Retted.*—There shall be three grades of maguey and sisal when the fiber is separated by retting the leaves in salt water. These grades are designated as follows:

Name of grade.	Approximate equivalent.
Mgy or Ssl 1	Maguey No. 1.
Mgy or Ssl 2	Maguey Nos. 2 and 3.
Mgy or Ssl 3	Maguey Nos. 4 and below.

4. *Maguey and sisal—Knife or machine cleaned.*—The grades for either maguey or sisal, when well cleaned by machinery or by knife, shall be three, designated as follows:

Letter of designation.	Name of grade.
A	Mgy or Ssl, good.
B	Mgy or Ssl, fair.
C	Mgy or Ssl, common.

The initials "Mgy" and "Ssl" placed before the name of the grade are abbreviations of the words "maguey" and "sisal," respectively, and their use is required more particularly in the knife or machine-cleaned fiber. The private grader should, therefore, inquire as to the identity of the fiber from the producer and affix the proper initials.

5. *Pacol, or wild banana.*—This fiber is produced in certain parts of the Philippine Islands from a plant known by the same name, which resembles both the abacá and the banana. It is considerably weaker than abacá, and its adulteration with this fiber is strictly prohibited.

There shall be recognized two grades of pacol, namely PCL 1, to apply to the well-cleaned fiber; and PCL 2, to aply to the strips or partially cleaned fiber. A further subdivision of these grades may be made in the future, if this fiber increases in importance and its trade conditions render such subdivision necessary.

II. *Determination of grades.*

The grading of any of the fibers mentioned in Section I, with the exception of abacá (Manila hemp) strips, shall be based chiefly on *color* and *strength,* at least in so far as the grading establishments are concerned. Other variations in the fiber arising from different methods or extent of preparation, or from other inherent characteristics, will be provided for in a manner to be explained later.

1. *Color and strength.*—The practical grading operation shall be based on the color of the fiber. This quality, therefore, will remain as heretofore the main basis of classification. The extent of variation in color allowable between one grade and another has been explained in the standard by means of equivalents to the more or less generally known grades of the old standard. A further light on the extent of variation in color between the grades of the standard will be given in the form of standard samples which will serve to interpret in a concrete form the variations allowable.

It must not be understood, however, that the strength of the fiber is secondary to color in importance. Under this new system a fiber, in order that it may be graded according to the standard, must possess the necessary strength, otherwise it will be classified as "damaged," irrespective of its color. An average breaking strength for each of the fibers included in these regulations will be published before the new system goes into effect. If the fiber is not damaged in any way, it may be considered as possessing the necessary strength, without any special tests being required. In ordinary cases it is assumed that the graders shall determine whether or not a fiber possesses the necessary strength by means of personal observation. In cases of doubt or dispute, however, actual tests by an adequate strength-testing machine shall be made by the Government inspector on special request.

2. *Methods of cleaning, or fiber extraction.*—The method of cleaning, or fiber extraction, will not be considered in differentiating between one grade and another in the same standard, as differences arising from that cause produce radical changes in the character and usefulness of the fiber. Hence, these regulations provide a separate set of standard grades for each of the well-cleaned and the partially cleaned abacá, and also the retted and machine-cleaned maguey and sisal.

In the case of standard grades of abacá strips, the grades shall be determined chiefly by the width of the strips, although color may also be taken into consideration.

3. *Texture, size, and length.*—Variations in the texture, size or length of the abacá fiber will not, under the new system, affect its grade. Such variations may be considered an advantage or disadvantage, depending on the nature of the uses for which the fiber will be employed. These uses are seldom known at the time the grading of the fiber is performed. Differences in these characters, therefore, produce variations in the type of the fiber and not essentially in its grade.

Designation of the type of the fiber in any grade shall not be obligatory on the grading establishment. The Government inspector shall explain in the certificate of inspection the type of the fiber in each lot inspected by him, basing his classification on the main characters of texture, size, and length.

Under *Texture* the fiber will be designated as "soft," or "hard," as the case may be.

Under *Size,* the fiber will be designated as "fine," or "bold," as the case may be.

Under *Length,* the fiber will be designated "long," when it exceeds 2½ meters (8 feet); "normal," when it is between 1½ meters (5 feet) and 2½ meters (8 feet); "short," when it is between 1¼ meters (4 feet) and 1½ meters (5 feet); and "very short," when it is less than 1¼ meters (4 feet) in length. These measures are approximate, and shall be taken from the head of the hank (butt end) to within 15 centimeters from the tips.

In order to facilitate the division of fiber into lots uniform in type (see Section III, 6), the abacá provinces of the Philippine Islands shall be divided into the following districts, the product of each of which may be considered by the grader as uniform in type and may be included in one lot:

Province.	District.	Abbreviation.
Ambos Camarines	North Camarines (Daet)	N. Cam.
	South Camarines	S. Cam.
Albay	Albay	Albay.
Sorsogon	North Sorsogon	N. Sor.
	South Sorsogon (including Masbate)	S. Sor.
Samar	North Samar	N. Sam.
	South Samar	S. Sam.
Leyte	East Leyte	E. Ley.
	West Leyte	W. Ley.
Mindanao	North Mindanao	N. Min.
	South Mindanao	S. Min.

The remaining abacá-producing provinces shall each be considered a separate district by itself.

III. *Baling and labeling.*

The following additional regulations regarding baling and labeling of bales, shall be complied with by all grading establishments:

(1) Each hank in a bale shall not exceed 12, nor be less than 6 centimeters, in diameter, before pressing.

(2) The dimensions of each bale of the grades "Extra prime," "Prime," and "Superior current," may be increased not more than 30 per cent over the measurements prescribed in section 5 (*a*) of Act 2380.

(3) The division of each hank into two or three parts, and the twisting of these parts in a manner similar to the twisting of the strands of a rope is prohibited. The hank may, however, be twisted as a whole once or twice, sufficiently to keep the fibers together.

(4) The hanks shall be laid straight in the bale, the heads (butt ends) in one row, alternating with the tips (points) of the next row. The hanks shall not be doubled upon themselves more than is absolutely necessary.

(5) Each bale of fiber shall be securely bound with not more than eight side and four end bands, made of the same kind of fiber as that contained in the bale, or of bejuco (rattan). The outer bands shall not be nearer than 10 centimeters to the edge. (See fig. 1.)

(6) All fiber on being graded shall be divided into lots. The fiber in each lot shall be of a uniform type, but may be of more than one grade. The lots must be numbered consecutively, and a range of numbers will be furnished each grading establishment along with the grading permits, which numbers shall be repeated on January 1 of each year. The inspection of a shipment of fiber shall be made on each lot separately, and a separate certificate of inspection given for each lot inspected. In order to avoid unnecessary confusion and to obtain uniformity of type, the attention of graders is called to the necessity of dividing their lots in such a way as to have in one lot fiber which comes from one province or district only (see the sixth paragraph of Section II, 3), and which is included in one set of standards. Otherwise, any readjustment of lots may entail unnecessary trouble and expense to the grader.

(7) Each bale of fiber shall bear, as explained later, two tags, one of

tin and one of russet 6-ounce strap leather, each 12 by 6 centimeters, connected by a piece of wire 50 centimeters long. The end of the wire which passes through the leather tag shall be tightly twisted around the main wire for a distance of at least 10 centimeters from the end of the leather. (See figs. 2, 4, and 5.)

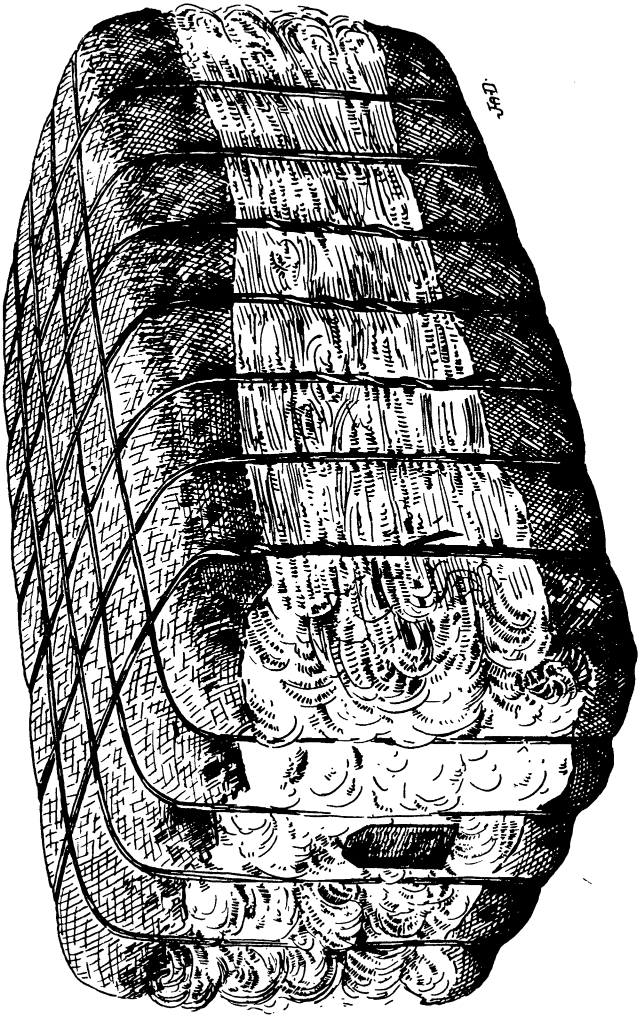

FIG. 1.—The completed bale, showing method of wrapping, binding, and tagging.

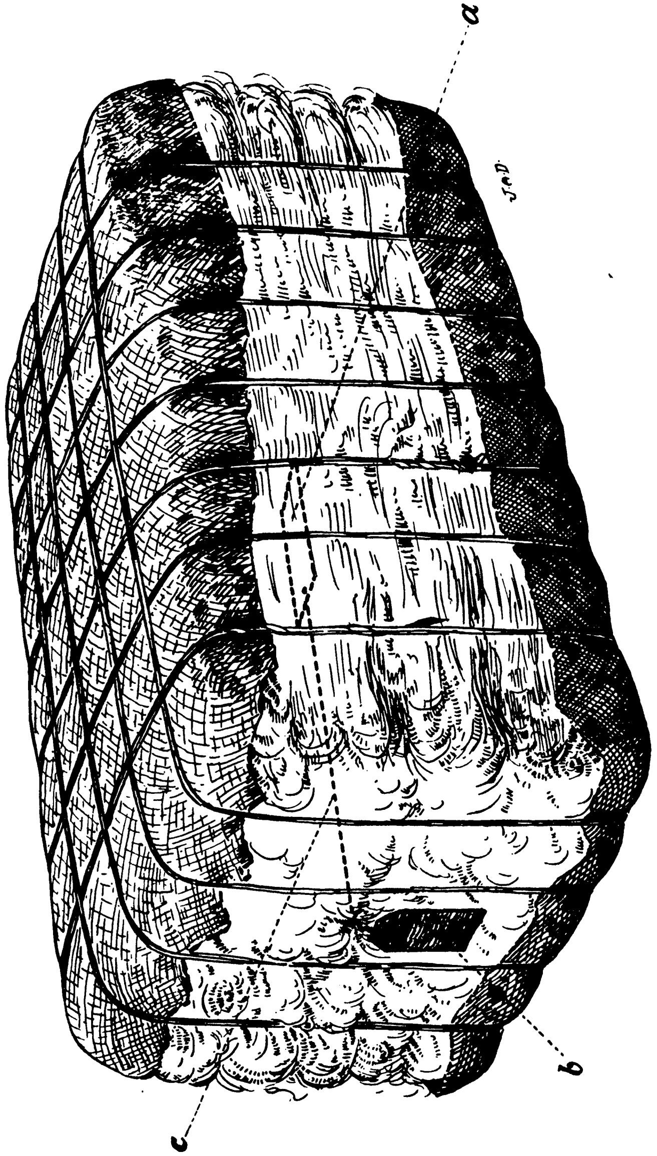

FIG. 2.—Cross section of bale, showing (*a*) tin tag in center of bale; (*b*) leather tag outside at end of bale; and (*c*) wire connecting the two tags.

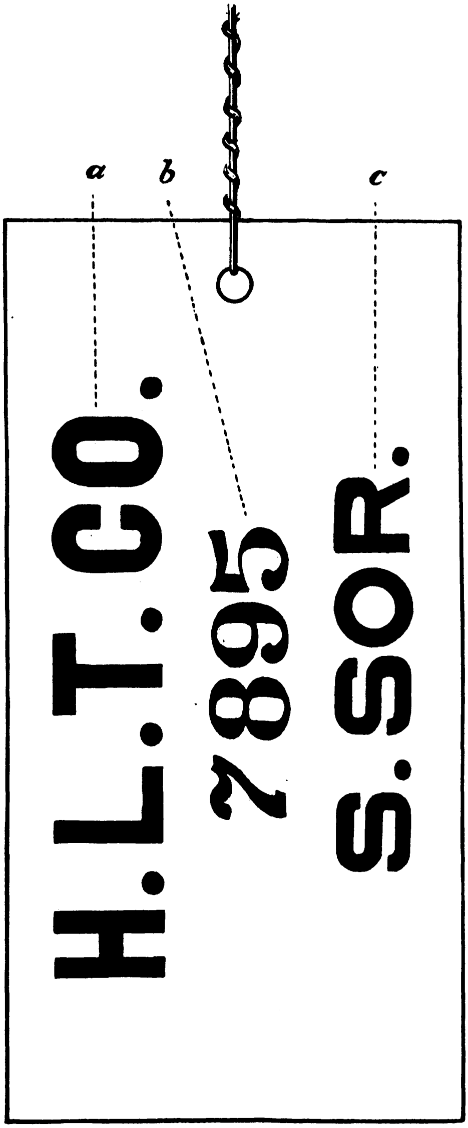

FIG. 3.—Tin tag, showing (*a*) abbreviated name of grading establishment; (*b*) number of lot; and (*c*) abbreviated name of province and district. (This illustration is the exact size of tag.)

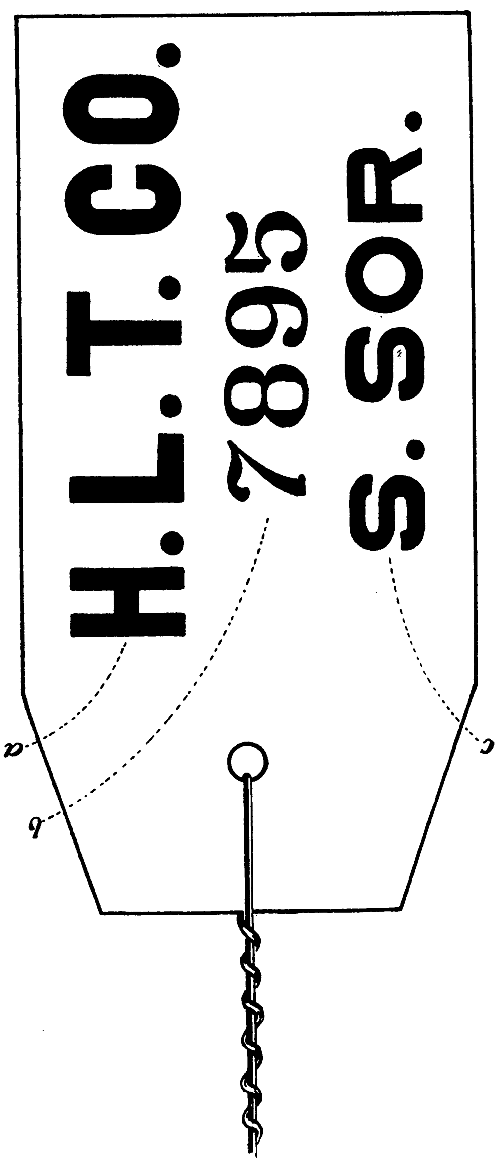

FIG. 4.—Showing one side of leather tag which bears the same data as appear on tin tag. (This illustration is the exact size of tag.)

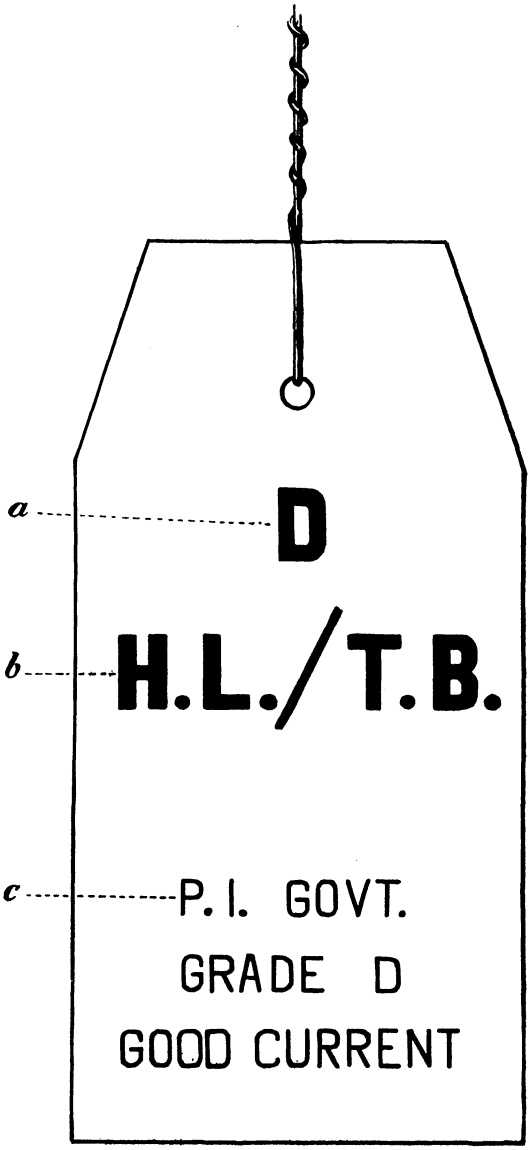

FIG. 5.—Other side of leather tag, showing (*a*) letter designation of the grade; (*b*) house mark; and (*c*) Government inspector's stamp indicating standard name of grade. (This illustration is exact size of tag.)

(*a*) The tin tag shall have the following data clearly impressed or stamped thereon: (1) The abbreviated name of the grading establishment, in letters 1½ centimeters in height; (2) the number of the lot, in numerals 1 centimeter in height; (3) the abbreviated name of the province or district, in letters 1 centimeter in height. (See fig. 3.)

(*b*) The leather tag shall have impressed or stamped on one side thereof the same data in the same sizes of letter or numeral as appear on the tin tag. (See fig. 4.) In the upper part of the other side of the leather tag shall be clearly impressed or stamped, in letters 1 centimeter in height, the letter designation of the grade and the house mark (if any) for that grade, the lower being reserved for the Government inspector's stamp which shall show the standard name of the grade. (See fig. 5.)

When the bale in the pressing box is halfway prepared for pressing the tin tag shall be placed at or near the middle of the bale, the wire extending to the middle of the end of the bale in such a way that the leather tag shall project beyond the end of the bale and shall be clearly visible. Only the loop of the wire which passes through the hole in the leather tag shall project beyond the end of the completed bale, the twisted part of the wire being entirely covered by the fiber.

H. T. EDWARDS,
Director of Agriculture.

Approved:
H. S. MARTIN,
Secretary of Public Instruction.

THE NEW SYSTEM OF REGULATING THE FIBER INDUSTRIES OF THE PHILIPPINE ISLANDS.

By M. M. SALEEBY, *Chief, Fiber Division.*

The Fiber Grading Law (No. 2[illegible]80), regulating the fiber industries of the Philippine Islands, was enacted by the Third Philippine Legislature in February, 1914. It is the purpose of this paper to describe the causes which have given rise to the establishment of this new system of regulating the fiber industries, as well as the advantages to be derived therefrom, basing the discussion upon actual facts pertaining to the condition of the industry both in the Philippine Islands and abroad.

CAUSES GIVING RISE TO THE GOVERNMENT REGULATIONS.

A careful review of the changes which have taken place in the abacá (Manila hemp) industry of the Philippines during the last eight or ten years will reveal certain prominent facts which can not be ignored or their influence on the general situation minimized. These are: First, a considerable increase in the number of grading establishments; second, a considerable and prejudicial decline in the quality of fiber; and third, a corresponding decline in the condition of the plantations (*lates*) in most of the chief abacá-producing provinces.

It was after a thorough investigation of the causes which led to the decline in the quantity of the fiber and in the condition of the plantations that the Government concluded that a new system should be put into operation for the purpose of improving the status of the industry both in the Philippine Islands and in the cordage markets of the world. All the establishments in the Philippine Islands which purchase, grade, and bale abacá, whether they are exporters or local dealers, were fully aware of the state of affairs and of the precarious condition of the industry in general, but they were either unable or unwilling to improve matters. The general condition of the industry had become so unsatisfactory that the Government was forced to step in to save the country's most important export product from disastrous consequences.

Increase in the number of grading establishments.—The increase in the number of grading establishments should not in itself be considered an undesirable factor. On the contrary it should, under some system, increase competition and stimulate business. There being, however, no fixed and generally accepted standard of grades and no specific instructions as to methods of baling, conforming to the requirements of the consuming markets, each establishment adopted practices of its own which in the majority of cases were neither kept constant by the same establishment nor did they correspond to those used by other establishments. In most instances the names of the grades were scarcely, if ever, used, and house marks were arbitrarily adopted to replace them; the grading and baling of the fiber was done in a very irregular way, and fiber was frequently baled in a wet and tangled condition. As if these methods were not serious enough to injure the industry, some even resorted to adulterating fiber of high grade with damaged or inferior fiber, the worst practice of all. Adulteration of abacá with pacol (wild banana) was also not infrequently practiced by some establishments.

Partly as a result of the increase in the number of establishments there was also brought about an undue increase in the number of grades. Ten years ago there were probably not more than six grades of abacá, and apparently the manufacturers were satisfied with those. Today there are more than four times that number and the tendency appears to be toward still further increase. There are several reasons why grading establishments increased or favored the increase in the number of grades, but these can not be discussed in this article. The multiplicity of these grades and their designation by the large number of house marks have not only completely confused the producer so that he is no longer able to tell the quality of his product with any degree of certainty, but have also puzzled the manufacturers and put them in the awkward position of not knowing what quality of fiber they will receive when ordering certain grades or marks.

Decline in the quality of the fiber.—The quality of the abacá fiber has gradually depreciated since the year 1906, and it is probably not mere coincidence that this decline in quality has been keeping pace with the increase in the number of grading establishments. The extent of the depreciation is not so noticeable in comparing the quality of the fiber produced in any one year with that in the preceding year, but it is easily seen, if, for instance, the quality of the fiber produced during the calendar year 1913 is compared with that, say, during 1906. Definite statistics with regard to the production by grades and the percentage of each grade to the total in any year are not available, but the following estimates collected from various sources may be considered sufficiently accurate for the purpose.

Approximate production of abacá by grades during the calendar years 1906 and 1913.

Grades.[a]	1906		1913	
	Estimated production.	Percentage of total.	Estimated production.	Percentage of total.
	Met. tons.		*Met. tons.*	
Extra prime and prime	14,400	15	8,330	7
Superior and good current	19,200	20	7,140	6
Midway and current	38,400	40	35,700	30
Seconds and brown	9,600	10	11,900	10
Fair and medium	9,600	10	41,650	35
Coarse and coarse brown	4,800	5	14,280	12
Total	96,000	100	119,000	100

[a] Refer to Bureau of Agriculture General Order No. 33, page 381, for the equivalent grades as heretofore known in the market.

The above table shows that the production of the coarse, or partially cleaned, fiber has considerably increased at the expense of the better grades, and it is this fact which constitutes the most serious aspect of the decline in the quality of the fiber. Well-cleaned fiber (soft fiber) alone shows the principal characteristics for which abacá is prized in the world's cordage markets, and the production should, as far as possible, be limited to those grades until the supply meets the demand. The highest grades of the coarse fiber, or strips, called "fair" and "medium," in the new standard, should not be prepared in excess of the specific demand therefor in the European markets, where they are specially required. As to the remaining coarse grades designated in the new standard as "coarse" and "coarse brown," it is believed that their production is prejudicial to the industry in general and to the producers in particular. The first step which must be taken to improve the quality of the abacá fiber should, therefore, be the prompt elimination of those coarse grades of abacá strips below "medium." Once this step is taken, further improvement in the quality of the fiber may or may not be necessary, depending upon the requirements of the markets.

From various sources it has been learned that the requirements for the different branches of the cordage industry in Europe and the United Kingdom is a production that will average as

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follows: Fifty per cent of the grades below current; 40 per cent of current and midway; and 10 per cent of good current and above. The United States markets, however, require a higher standard of quality averaging approximately as follows: Twenty per cent below current; 60 per cent current and midway; and about 20 per cent good current and above.

After having shown the extent to which the quality of abacá fiber has declined in recent years and the approximate extent to which it should be raised, the next question that arises is naturally as to the cause, or rather the causes, which together brought about this decline. On this subject there is a difference of opinion, but the majority of the local and foreign buyers appear to place the blame entirely on the producer. The producer, of course, prepares these low grades now in preference to the higher ones which he prepared in former years, and apparently he is given the entire blame. Careful investigation of the manner in which the product is handled in the provinces from the time it leaves the producers' hands until it reaches the large buyers and exporters reveals certain facts which must be taken into consideration before blame can well be placed on any one. It cannot be denied that the producer in former years turned out much higher grades of fiber than at the present time and that he is just as able at the present time as he ever was before to prepare the same grades. This, in itself, leads us to the question as to why the producer has changed his former practice of preparing the higher grades and is now producing the lower grades instead. In former years the grades of coarse fiber, or strips, were hardly known to the market, and, therefore, there was no particular demand for them and the producer did not prepare them to any extent. Whichever party, therefore, introduced these grades into the market must bear a large share of the blame. A number of the most prominent manufacturers in Great Britain informed the writer that they were not responsible for the production of these grades, and that while they will purchase them in limited quantities as long as they are produced, they would rather have their production prohibited. The local buyers state that they purchase these grades because there is a special demand for them in the European market, and that if the demand for them ceases they naturally would not purchase them. The producers contend that they prepare these grades in response to a specific demand for them in the local market, and that in many cases they are paid relatively a much higher price for these lower grades than for the higher ones.

This latter statement was investigated by the fiber division of this Bureau, and was found to be a fact. Many of the smaller buyers in the municipalities were paying at the rate of 28 and 18 centavos per kilo for good current and fair current, U. K., respectively, at a time when these same grades were being purchased in the Manila market at 48 centavos and 22 centavos per kilo, respectively. Transportation, grading, baling, and other charges are the same on a good current and a current U. K. fiber, and there can be no just reason why the producer should be paid only 55 or 60 per cent of the value of his good current, when he is paid about 80 per cent of the value of his current U. K. The same treatment also applies to the prices of the still lower grades, and this is, in the writer's opinion, directly responsible for the continued tendency on the part of the producer not only to prepare a coarse product but also to resort to mixing inferior fiber or pacol with the higher grades of abacá and to also pack his bundles when the fiber is still wet. In other words, the producer knows that he is not paid sufficiently for his product, and, finding himself powerless to demand and receive just treatment, resorts to the aforementioned practices in the belief that these are the best means of protecting his interests.

It is this improper method of dealing with the producers on the part of some of the local buyers which has given rise to the oft-quoted statement by the producer to the effect that he makes more money by preparing the lower grades, which statement has recently been accorded general credence. It is not necessary at this time to show that, giving the producer fair treatment and justice, he would almost invariably resort to the production of the higher grades. A proof of this statement is found in the fact that many intelligent and progressive producers of abacá who understand the quality of their product and its value, and who are in a position to dispose of their fiber directly to the leading buyers in the provincial centers or in Manila, find it to their advantage to maintain a high standard of quality.

The effects of this decline in the quality of abacá cannot be overestimated: First, the consuming markets are being flooded with large quantities of undesirable fiber which at the present time the manufacturers are utilizing, among other minor uses, for mixture with the better grades, with the consequences that the reputation of Manila rope has been seriously injured; second, abacá is meeting with serious competition from other fibers, and it has already been practically excluded from the bindertwine trade (in certain grades of marine cordage also, German East African sisal is said to be slowly but steadily replacing abacá); third, the supply of the higher grades of abacá has recently been so seriously reduced that their price has become in many instances practically prohibitive and steel is being used to replace them; fourth, the economic status of the abacá producer has been gradually declining, and in many instances he has already decided to turn his attention to the production of some other more profitable crop.

It is evident that any one of the above causes is sufficient to kill, or at least retard the progress of, any industry; and the only reason that the abacá industry of the Philippines has survived is because this country still has a monopoly in the production of abacá and because the production of other competing fibers has not as yet increased sufficiently to meet the demand. It is indeed a very gloomy future for our industry if no remedy can be immediately applied. The buyers of abacá in the Philippines are either unable to apply the necessary remedy, or they are indifferent about it. In any case it was imperative that the Government should step in and use every means in its power to save this most important industry, and it has already endeavored to do so.

Decline in the condition of the abacá plantations.—Perhaps one of the most lamentable phases of the abacá industry at the present time is the present condition of the majority of small plantations, or *lates,* throughout the chief abacá-producing provinces. It is true that, as a rule, modern methods of agriculture have not been employed in the cultivation and production of abacá, but nowadays even the old and crude methods of cultivation are very sparingly employed by the farmers. To begin with, the majority of *lates* are old and need renewing. The weeds are not as carefully and regularly cleaned as in former days, and the establishment of new plantations is on a much smaller scale than at any period when normal conditions existed. No material improvement in the present condition of the plantations can be effected without the resort to more up-to-date methods of renewing the old plants and of giving them all the care they require prior to and after the time they arrive at the producing stage. The crude and old methods are now utterly inadequate to restore these old plants to a paying condition, owing to the impoverishment of the soil through the continual drain on its supply of plant food, and also to the long neglect to which the plants have been subjected. No up-to-date methods can now be employed without capital to pay for the necessary labor, and to purchase agricultural implements and work animals. The same requirement applies to the establishment of new plantations.

The majority of the producers of abacá are small land owners, and during the last eight years it may be safely stated that they have been earning only enough to supply the necessities of life. Nothing else can be expected when they are found producing such low and coarse grades of fiber for which they can obtain a price averaging no higher than 15 centavos per kilo. The average production per hectare on those plantations is probably not higher than 450 kilos, thus giving a maximum gross revenue per annum from one hectare of about ₱68, practically half of which goes to the laborers who strip the fiber.

The Government realizes the urgent necessity for the improvement of the abacá plantations and the fact that no such improvement has so far been effected should not be taken to mean that the Government has not shown the producers the proper methods to employ, but that the producer is not in a position to carry on any improvement work on his plantation, and will not be able to do so until after he shall have improved his product and obtained better and more legitimate prices for it. While the Government intends to help the producer to improve his plantation, it has also found that he needs help in another direction, and that immediately. The educational campaigns which are to be instituted by the Government will have for their ultimate object the enabling of the producer to understand the quality as well as the value of his product in the hope of his ultimate ability to improve his economic status. Once this is accomplished, the producer will be in a position to apply the improved methods of cultivation and renewal of old plants which have repeatedly been recommended by the Bureau of Agriculture and which have been adopted to great advantage by the more progressive class of producers.

Recapitulation.—In summing up the whole situation, the following causes upon which the action of the Government in regulating the industry was based stand out prominently:

First. Lack of system for grading and baling fibers among the ninety odd establishments now in operation throughout the Islands. Eight years ago grading and baling was practically entirely carried on by a few large and reliable firms which are continually in contact with the consuming market and its requirements. Today perhaps not more than ten or fifteen per cent of the fiber exported is graded and baled by these establishments, the remainder being graded and baled by provincial establishments among which and between whom and the exporters there is no cohesion nor common understanding of the exact requirements of the market.

Second. The number of grades has been increased to an unwarranted extent, and house marks have almost entirely been used to designate these grades. The complications arising from this source have completely confused the producers as to the exact quality of their product, and have also considerably confused the consumers with regard to the quality of the fiber as designated by a large number of house marks.

Third. The ignorance of the majority of producers as to the quality and value of their product as a consequence of the complexity of the present methods of grading has unfortunately afforded an excellent opportunity for some local buyers to profit by not discriminating sufficiently in the matter of prices, thus encouraging not only the production of inferior quality of fiber, but also the practice of fraudulent methods on the part of the producers.

Fourth. The decline in the average quality of abacá, in consequence of the above state of affairs, has seriously affected the status of the industry in the consuming markets, and has also afforded an opportunity for serious competition from other cordage fibers.

Fifth. In proportion to the extent of the decline in the quality and value of the fiber, there has also been a corresponding decline in the condition of the plantations and in the economic status of the producers in general, thus seriously injuring the industry at the source of production also.

ADVANTAGES OF THE GOVERNMENT REGULATIONS.

The foregoing explanation of the true state of affairs of the abacá industry, both at the source of production and at the consuming markets, will at once indicate that the decision of the Government to step in and regulate matters is not only warranted, but is rendered an absolute necessity to save the industry from certain disaster towards which it has steadily been drawn, and to put it on a more stable basis and thus enable it to regain its former state of prosperity.

The object of the Fiber Grading Law and the regulations authorized by it can easily be understood after a careful review of their provisions. Each and every one of the defects in the system heretofore used has been made an object of practical reform, the proper application of which it is hoped will produce the anticipated advantages to the industry in general.

The first defect in the old system, referred to under causes giving rise to the new regulations, is the increase in the number of grading establishments, among which there is no common understanding as to fixed regulations for carrying on the work, nor a fixed standard to which the grading of all should conform. Section 2 of the Fiber Grading Law provides a remedy for the above defect by requiring that a fixed official standard of grades be determined and established; that copies of these standard grades be obtained by every establishment; and that the grades of each establishment conform to the corresponding grades of the official standard. The advantages of the application of the provisions of this section of the law will be to make the grades of the different establishments more uniform, and thus eliminate the chief objection to the increase in the number of establishments.

The comparatively recent increase in the number of grades of abacá, which is one of the main defects of the old system, whether partly or wholly caused by the increase in the number of establishments, is provided against by subsection (*c*) of section 2, and more directly by Section I of Bureau of Agriculture General Order No. 33, authorized by the above subsection of the law, by which the number of grades has been reduced from twenty-five or more to only twelve grades, and by which also the grading is determined on a more definite basis. The use of house marks to designate grades, which has also been a very annoying phase of the old system, is provided against by subsection (*a*) of section 4, which limits the use of house marks, under certain conditions, to those establishments which export the fiber to foreign markets and which are in direct communication with the manufacturers. Both the reduction in the number of the grades and the limitation of the use of house marks will unquestionably simplify the grading to such an extent as to enable the graders to perform more uniform work than heretofore, and will also enable the producers to understand more readily the quality of their product. The advantages accruing to the manufacturers from this reform are of equal importance, as they also will be enabled to obtain as nearly as possible the desired quality of fiber.

The injury to the reputation of the abacá fiber in the consuming markets, which has recently been brought about by baling the fiber in a damp and tangled condition, by the adulteration of the high and medium grades of fiber with fiber of an inferior quality or with pacol, or by faulty methods of baling and labeling, is also provided against by section 5 of the law and by Section III of General Order No. 33. These regulations specify a limit to the size of hanks; require that the fiber be baled untangled and only when thoroughly dry; prohibit adulteration of any kind; and require that the baling and labeling should be performed in accordance with certain instructions. The advantages of the application of these regulations will protect the exporters and buyers of the fiber against any fraudulent practices by the smaller establishments or by producers, and will encourage more honest dealing on the part of all concerned.

It was explained before that one of the main causes for the recent decline in the quality of the fiber has been the ignorance of the producers as to the real quality and value of their product, and that also, in consequence of the continued decline in the quality of the fiber, there has been a corresponding decline in the condition of the plantations. Subsection (*d*) of section 6 provides a suitable remedy for these unfortunate results by the detail of a certain number of fiber inspectors and the organization of an educational campaign among the producers. The object of this campaign will be to impart directly to the producers a knowledge of the grades of abacá and their value at the time in the Manila and the provincial markets, and also to give them necessary instructions for the improvement of their plantations and the quality of their product. This will, more than anything else, enable the producers to deal more intelligently with the local buyers, and it ought ultimately to put them in a position to improve their economic status.

One notable feature of the fiber-grading law, which should not be overlooked in a discussion of this kind, is that it provides that all grading establishments shall obtain special permits authorizing them to practice their work, and that their work at all times shall be open to the inspection of Government inspectors. This inspection will not be restricted to the premises of the establishment nor to the manner in which the work is conducted, but will also include the examination of a certain percentage of the bales before they are sold or shipped and a certification as to whether or not the grading and baling is in accordance with the regulations in every respect. If the bales are approved by the Government inspector, they will be certified to and stamped. This double inspection should be an additional guarantee to all buyers of the fiber, whether in the Philippines or abroad, that the grade of the fiber in the lot inspected and approved corresponds to what it is claimed to be, and this inspection, therefore, should be welcomed by them.

The new regulations do not go into effect until the first of January, 1915, but the fiber division of the Bureau of Agriculture has already commenced the preliminary work necessary before the enforcement of the law on the above date can be effected. Bureau of Agriculture General Order No. 33, embodying additional regulations to those contained in the law, has been published;[1] the official standard grades have been determined and established; and secondary samples of the standard grades have been furnished the manufacturers in the United States and Great Britain who are known to this Bureau, and also to the local grading and baling establishments. The necessary force of inspectors for carrying on the work during the next year is being rapidly organized, and the training of the inspectors has already begun. Finally, no effort is being spared which will tend to make the application of the above regulations practicable and conducive to accomplishing the reforms necessary for the welfare of the fiber industry in general.

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[1] See page 381.

DESCRIPTION OF THE STANDARD GRADES OF ABACÁ (MANILA HEMP).

By M. M. SALEEBY, *Chief, Fiber Division.*

The number and designation of the newly established standard grades of abacá (Manila hemp), of both the well-cleaned and the partially cleaned forms, are explained in Sections I and II of Bureau of Agriculture General Order No. 33, which is reproduced on another page of this REVIEW. The explanation of the grades in the general order is made in a manner familiar to the trade, and is considered for all practical purposes sufficiently clear to the graders of the fiber as well as to buyers and manufacturers, who are all more or less acquainted with the generally known terms of the old standard. Section II of the above-mentioned general order states the chief basis on which the grading of abacá is determined, but in it no attempt is made to give a specific description of each grade, neither in itself nor with relation to the grades above or below it. To give such a description of each grade is the object of this paper, and it is intended that this be based on the apparent qualities of the fiber, such as color, cleaning, texture, and length, but particularly on the color and cleaning, as it is considered that the remaining qualities have been sufficiently well explained in the aforementioned sections of the general order.

In the case of abacá, perhaps more than any other hard fiber, such a description is difficult, and it is presupposed that the reader should have a practical knowledge of all the commercial grades of abacá before he could thoroughly understand this description. It is true that an accurate understanding of the grades of abacá can only be obtained by continued examination and handling of the fiber on a more or less large scale. Even a small sample representing any of the grades is not sufficient to give a person an accurate conception of that partiular grade. The same thing is true in the case of almost all other fibers, although abacá presents a particular difficulty, owing to the crude methods used in its preparation and preliminary handling. Granting all these difficulties, it must be admitted that a specific description of the grades, although it may be unintelligible to the layman, may prove of considerable help to all persons possessing experience in buying or handling fibers.

In giving such a description of the new standard grades of abacá, the well-cleaned fiber and the strips will be dealt with separately, the same as in the general order and for the same reasons given therein. The lowest grade of each class will be described first, and the description will proceed from that to the next higher one, until the last or highest grade is reached, thus showing the graduation which exists in the apparent characteristics of each grade.

THE STANDARD GRADES OF ABACÁ FIBER.

Brown.—This is the lowest grade of the standard for the well-cleaned fiber. The color of the fiber encountered in this grade is usually brown or dark red, mixed with light purple or light burnt sienna, the latter being predominant towards the tips. The part of the fiber from the middle to the tips is usually darker than the rest, which is due to the manner in which the strips are pulled under the knife and to the fact that the exterior sheaths, from which this grade is usually prepared, are thin toward the tips, and are also usually in a more or less dried condition, which renders the cleaning of the pulp from the fiber rather difficult.

As a rule this grade is prepared from fiber obtained from the outside sheaths of the abacá stalk, which in some varieties are of a dark color. These sheaths do not extend the whole length of the stalk and for this reason the usual length of the fiber in this grade is much less than its length in the other grades, rarely exceeding 1½ meters (5 feet), and more frequently less than that.

This grade may also be encountered in fiber produced originally of a better grade but which, owing to subsequent neglect or exposure to dampness, becomes darkened. Such fiber usually has a greater length than that of the typical grade.

The texture of the fiber in this grade is either soft or medium, depending upon the degree of cleaning. The fiber of the medium texture is that usually produced when the adjustment of the cleaning knife is somewhat faulty and pieces of the dark skin of the fibrous strips remain attached to the fiber. This skin, being very thin and pulpless, and not being found in considerable quantities, does not prevent the fiber from being included in the standard for the well-cleaned fiber. Certain varieties of abacá in certain districts produce a hard[1] and wiry, though very well-cleaned, fiber of this grade. The same thing may be said in the case of each of the succeeding grades.

This grade includes the soft Good brown and soft brown (red) grades of the old standard, and is produced chiefly in Leyte, Samar, Sorsogon, and to a less extent in other provinces.

Seconds.—This is the next highest grade of the standard for the well-cleaned fiber. The color of the fiber encountered in this grade is usually light brown or light red mixed with yellow ochre in variable proportions. Here also the part of the fiber from the middle to the tips is usually darker than the rest, for the reasons mentioned in connection with the preceding grade.

As a rule, this grade is prepared from fiber obtained from the sheaths next to those on the outerside of the abacá stalk. These sheaths are partly exposed to the sun and partly covered by one of the preceding outside sheaths, which explains the spotty or "streaky" characteristic of the typical grade. However, it is not always the exposure of the sheath to the action of the sun that causes this discoloration, but any local injury to the stalk, such as a bruise, may produce the same effect. In a few cases, sheaths from even the middle of the stalk are sometimes similarly affected, and their fiber is of necessity graded as seconds. The difference between the discoloration caused by exposure of the sheaths to the sun and that caused by a bruise is that the former is somewhat reddish in color while the latter is light yellowish.

This grade may also be encountered in fiber originally of a higher grade, but which, owing to exposure to dampness or to some other cause, becomes slightly darkened. The color of such fiber, however, is not exactly the same as the typical color of this grade, and may be called dirty red instead of light red. In such fiber also the discolored spots are absent or rare, and the length of the fiber is more than the average for the typical grade.

The length of the fiber in the typical grade is about the same or a little more than in the preceding grade. In other than color and length, the remaining apparent characteristics of the fiber are practically the same as in brown.

This grade includes the soft superior, good and fair seconds of the old standard, and is also produced chiefly in Leyte, Samar, and Sorsogon, and to a lesser extent in other provinces.

Current.—This grade is unquestionably the most important of all the grades of abacá. Its importance does not consist in any superior quality of its fiber but in the extent of its supply and in the demand for it for cordage purposes. It is the lowest grade of the second group of grades which comprises also midway and good current, the grades seconds and brown forming the first or lowest group. Owing to its importance, and also to the fact that it has been the basis for the determination of the higher grades by the percentage system, a thorough knowledge of the characteristics of this grade is therefore of special importance; before proceeding to describe this grade, however, it must be mentioned that it has been one of the most variable grades, its old standard having been recently lowered in proportion to the decline in the general quality of the fiber. The current of to-day, therefore, is of a much lower standard than the current of ten or more years ago. In the new standard there has been no attempt to restore it to its old standard, nor to raise it very materially from its most recent standard, as such action would possibly cause considerable confusion in the market.

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[1] The term "hard" is here used in preference to "coarse," because the latter has heretofore been used in reference to the strips, or partially cleaned fiber.

The color characteristic of the grade current is rather difficult to describe. It is a shade of very light brown or red, approaching light ochre. The streaky color characteristic of the typical seconds and brown is generally absent. The color of the fiber in this grade is caused chiefly by the action of the acid whenever this is allowed to remain on the fiber for any length of time, such as often happens when the fiber is either not thoroughly cleaned or when it is not properly dried. This shows that the current color cannot be ascribed to any natural cause. With proper cleaning of the sheaths of abacá, and with proper drying of the fiber immediately after cleaning, it will be found that a very small proportion of it, indeed if any at all, can be classed as current. The sheaths of the abacá stalk from which is largely produced the grade current are those constituting the third group of sheaths in the stalk, which are, as a rule, thicker than the inner sheaths and possibly contain a larger amount of ~~soap~~ sapo.

The texture of the fiber in this grade is also of two types—soft and hard. The soft current is produced in those districts in which, either owing to particular characteristics of soil and climate or to cultural varieties of the plant, the fiber is naturally soft in texture. In these same provinces, however, we often encounter current fiber of a more or less hard texture, which is caused by the manner of cleaning. In some cases the serrations in the knife and the adjustment of the pressure of the knife on the block of wood are such as to allow a quantity of pulp to adhere to the fiber. The amount of pulp not being sufficient to cause the placing of this fiber in the standard for strips, the fiber is considered for all practical purposes as being well cleaned. The term "well cleaned" in this grade, as well as in the two preceding grades, should not therefore be taken in its absolute significance.

The normal length of fiber is generally encountered in this grade. The length, of course, depends upon the length of the sheaths from which it is extracted, and in the case of this grade the latter are of the same length as the stalk itself.

This grade includes the following grades of the old standard: Current U. S., 12½, 25, and 37½ per cent over current. The writer never acknowledged the existence of the grades 12½ and 37½ per cent over current, which in no case have been found to be definite or sufficiently distinctive. The grade 25 per cent over current, in all instances in which the writer has had occasion to inspect it, was found to be nothing more nor less than midway and current fiber mixed in equal proportions.

Midway.—As the name implies, this grade is the medium grade of the second group, and represents in color a halfway transition from the current to the good current. The predominant color of this grade may be described as light ochre, and is often interspersed with small quantities of fiber of an ivory-yellow color, which really belongs to a higher grade. The color characteristic in this grade is natural and not accidental as in the grade current, although the careless handling of the fiber immediately after it is extracted often results in reducing to midway fiber originally of a higher grade.

The presence of partially cleaned fiber is not infrequently met with in this grade, and is caused by the improper adjustment of the stripping knife. In this and the succeeding grades the presence of such strips should be discouraged, as it is really in these grades that the special and most-prized characteristics of the abacá fiber are exhibited.

This grade includes the midway and 75 per cent over current of the old standard. The latter grade, like the 25 per cent over current, consists of midway and good current fiber mixed in equal proportions.

Good current.—This is the highest grade of the second group, and its predominant color is a very light ochre interspersed with small quantities of fiber of an ivory yellow or white color.

The fiber in this grade is as a rule still better cleaned than that in the midway, and is also generally of a softer texture. In this grade no partially cleaned fiber should exist, not even in small quantities, although this is encountered in some instances. The texture of the fiber in this grade is, therefore, governed entirely by the variety of the plant and the district of production.

It is unfortunate that the production of this and the succeeding grades has considerably declined during recent years, and it is estimated that not more than 3 to 4 per cent of the total production is of good current. With proper management and proper control over labor, the average yield on a plantation should not be under good current. In all instances where more or less up-to-date methods are being used by the progressive element of planters in the Philippines, it may be safely stated that the average production is rarely under good current, and in some cases it is indeed higher. A thorough application of modern methods of culture and fiber extraction in the Philippines would, therefore, tend to raise the present average production from current to good current.

This grade includes the good current and 25 per cent over good current of the old standard.

Superior current.—This grade is the lowest of the third or superior group of grades. Its predominant color is light ivory yellow, a considerable portion of which usually approaches white. In length and texture the fiber in this grade runs very much the same as that in good current, the length being usually equal to the length of the stalk, and the texture being governed by the variety characteristics and by the local climatic and soil conditions.

This grade is largely produced in Sorsogon, northern Samar, western Leyte, and southeastern Mindanao. Its production is now about the same as that of good current, but it is expected that it will increase in the future, owing to the increased demand for it for braid purposes, especially in the Japanese market.

This grade includes the 50 per cent over good current and the so-called superior good current of the old standard, and also Grade No. 4 of the more recent standard for the grades intended for the manufacture of braid.

Prime and extra prime.—These grades constitute the second and first, respectively, of the third or superior group. They are described together because their characteristics are very much the same in every respect, with the exception of color, which, although practically white in both grades, is more so in the extra prime than in the prime.

The larger proportion of the fiber produced of these grades is either soft or medium in texture, and rarely hard. Hard fiber of these grades is produced principally in the Davao district in southeastern Mindanao. Perhaps the best fiber of these grades is that produced in Cavite Province which is usually of a medium texture and possesses a rare luster.

There is a very limited supply of these grades, and the demand for them for ordinary cordage purposes is also very limited. All fiber of these and the two previous grades which is of a medium or hard texture, of seven feet or more in length, and free from tow and untangled, is now almost exclusively exported to Japan and Europe for textile purposes, principally for the manufacture of tagal braid.

The larger part of the supply of these grades comes from Davao, Cavite, Batangas, from some of the less important abacá provinces and also from a few individual planters in the more important provinces.

The grades extra prime and prime include the grades designated in the old standard by the marks F. E. A. and F. E. B. quality, respectively.

STANDARD GRADES OF ABACÁ STRIPS.

There are four grades included in this class of fibers, namely, coarse brown, coarse, medium, and fair. These grades are determined not so much by the color characteristic as by the width of the strips. The standard strength of the fiber in these grades also is important, forming, as in the former grades, the basic characteristic. The color in these grades, though not so important as in the grades of the well-cleaned fiber, is also considered and is given a wider range than in the latter grades.

Coarse brown.—This is the lowest of the grades of abacá strips. The width of the strips in this grade is usually about one and one-half to two millimeters. The strips are thick, and are also rough on the lower side, owing to the presence of pulp. The color is usually that of seconds or brown.

In texture the strips are naturally hard, whether originally of a soft or hard nature. In the typical grade the length is usually that of seconds or brown.

In texture the strips are naturally hard, whether originally of a soft or hard nature. In the typical grade the length is usually that of seconds or brown, although the normal length is encountered in strips which were originally prepared of a higher grade.

This grade corresponds to the Daet reds of the old standard, and, as the latter name implies, it is produced almost exclusively in the Daet district of the Province of Ambos Camarines.

Coarse.—In width and thickness the strips in this grade are similar to those in the preceding grade. The color is higher and is similar to that of current or even midway.

The texture of the strips is also similar to that of coarse brown, and the length is also similar to that of coarse brown, but the length is as a rule greater than in the latter grade.

It is very doubtful whether this and the preceding grade can be used to advantage for cordage purposes, excepting perhaps as a mixture with the higher grades. For this and various local economic reasons the production of these two grades is considered prejudicial, and every effort should be made to discourage it. There can be no doubt that the production of these grades has hurt the reputation of our abacá fiber more than any other one factor.

This grade includes the Daet seconds and Daet current of the old standard, and is also produced almost exclusively in the Daet district of Ambos Camarines.

Medium.—This is the third of the standard grades for abacá strips. The average width of the strips in this grade is about 1 millimeter, and the strips are, as a rule, smoother on the lower side and practically free from pulp. The color is either that of seconds or brown, or similar to that of coarse brown.

The texture in this grade is comparatively softer than that of coarse or coarse brown, for the reason that the strips are usually thinner and are often mixed with a small quantity of well-cleaned fiber. The length of the fiber is usually the same as that of coarse brown.

This grade includes the so-called coarse seconds and coarse brown of the old standard. It is produced in several provinces in the Philippines, but principally in Albay and Ambos Camarines.

Fair.—The average width of the strips in this grade is about three-fourths of a millimeter to a millimeter, and the strips are usually thinner and contain less pulp than in any of the previous grades of this class of fiber. The color is ordinarily that of Current.

Among the abacá strips this grade occupies the same rank of importance as that of Current among the grades of the well-cleaned fiber. The latter is particularly in demand in the American market, while the former is in demand in the British market, hence, their old designation as current U. S. and current U. K., respectively.

As in the coarse, the length of the fiber in the grade fair is entirely governed by the length of the stalk from which it is extracted. The texture of the fiber is, as a rule, softer than in any of the previous grades in this class of fiber, and is either medium or hard, depending chiefly upon the quantities of well-cleaned fiber mixed with the strips.

This grade includes the so-called coarse superior seconds and the current U. K. of the old standard. It is produced in several provinces in the Philippines, chiefly in Albay and Ambos Camarines.

THE REJUVENATION OF DEPLETED ABACÁ FIELDS.

By FRED. P. NICKLES, *Agricultural Inspector.*

The methods generally used at the present time for the production of abacá are practically the same as they were many years ago when the fiber began to be an important article of commerce in the Philippine Islands. During these years great advances have been made in agricultural pursuits and the question may well be asked as to whether the methods used today for the production of abacá are the best that may be had with our present knowledge of the science of agriculture.

In January, 1912, the Bureau of Agriculture started a series of experiments at the La Carlota experiment station in Occidental Negros to determine some of the many points in which it seemed probable that improvements might be made. These experiments are far from completed at the present time but already they have proved instructive. Individuals, also, notably in the Moro Province, have attempted certain changes in their usual methods and with considerable success. Based upon results of tests and investigations made by the Bureau of Agriculture, and upon methods adopted to advantage by various individual planters, certain methods have recently been devised for the production of abacá, which are decidedly superior to the general practice now in use. For the purpose of bringing them before the abacá producers, demonstration work was recently started in the Bicol Provinces, and it is hoped that eventually these methods may be generally adopted throughout the abacá-producing provinces. It is the purpose of this paper to fully described them so that they may be sufficiently understood to put them to practical use.

First, the conditions as they exist in the industry to-day should be described so that the application of any system of improvements may be better understood. If the old abacá fields are compared with those more recently planted or with those which are more favorably situated with respect to soil fertility, one quickly realizes that a very large percentage of the abacá land is producing much less fiber than it could. In many districts there are, of course, large areas of virgin soil suitable for abacá, which might be planted and which would produce a superior crop for several years. Most of this land is inaccessible, however, and with the common methods in use, it would eventually degenerate to a state similar to that existing at present. Improvements should be applicable to the older abacá fields as well those to be planted for the first time.

In considering the present methods for growing abacá, the lack of any process which can be called genuine cultivation, using the word in its narrower sense, should be noted. The nearest to it that may be found in the abacá fields is a spasmodic cutting of grass and weeds with the bolo. The life of the abacá plant is twelve to twenty years. When the plants die they are replaced by transplanting a few single plants to the spots left vacant, and the planting is done unsystematically and too closely. There is practised neither cultivation, rotation of crops nor fertilization in any form. That they produce as well as they do, is a proof of the fertility of Philippine soils.

Naturally, then, cultivation is the first and most logical way to bring about the desired increase in the yield of plantations. At present there does not seem to be any crop which may be grown extensively in rotation with abacá. As for fertilization, the usual practise of applying commercial fertilizers or animal excrement is, in the majority of cases, too expensive to be justifiable. From cultivation an elimination of foreign vegetation, a more rapid conversion of plant food in the soil into a form available to abacá and a great improvement in the physical condition of the soil may be expected. These results would tend directly to increase the growth of the plants. Cultivation, however, necessitates the expenditure of money. Since the returns per hectare are relatively low in this industry, the problem is to keep this expenditure down to a point where it is justified by the increase in profits. This has been accomplished by using cowpeas (sitao) as a cover crop and green manure. The principle features of these methods are, *absolutely clean preliminary cultivation,* and the *planting of cowpeas as a cover crop and green manure.*

The best time to start the preliminary cultivation is the last part of the dry season when the hot sun and the generally dry conditions greatly assist in the killing of weeds and the burning of trash. By the time the preparation is finished, the rainy season will be at hand and the field may be planted.

The clearing of the field is the first operation. All trees, brush, and old abacá should be dug up and removed or burned. Exception may be made to a few varieties of trees which are beneficial to abacá for their shade. It is better, however, to remove all trees. Shade trees may be planted later in a systematic manner. When the larger vegetation is removed, the field should be plowed, the number of times depending on conditions, but not less than three times will always be necessary. A period of one week may advantageously be left between plowings in order that weeds and grass lying exposed may be killed by the sun. The plowing should be at least 20 centimeters in depth. If light plows are used, this depth may easily be reached by passing the plow twice in the same furrow. The field should finally be harrowed once or twice to smooth it.

The best plow to use in large and comparatively level fields free from rocks is a heavy steel plow requiring the use of four animals. This plows a deep, wide furrow and is not easily broken on roots or stumps. Since many of the laborers in the abacá districts are not familiar with heavy plows or the handling of so many animals together, the light steel plows requiring only one animal may be used. These would also be better in rocky and small fields. Plows of this type with a single handle are sold by two or three companies in Manila at very reasonable prices. The ordinary native plow which merely scratches the top of the ground is of no value in this work. Several types of harrows might be used but probably the best for the purposes of the abacá grower is the type called the "Shear harrow." This has the advantage of being comparatively light and since one is not apt to encounter heavy sod in abacá fields, it will do efficient work. Cultivators will also be necessary, to take the place of the harrow after the abacá has been planted. The only other tools needed are shovels to be used in planting the abacá, the round-pointed kind being the best.

The planting should be done about the beginning of the rainy season or shortly before. In this connection, it is best to plant the cowpeas first. In case seed is not available at the time, they may, however, be planted after the abacá is up. The cowpeas should be sown broadcast, rather thickly, and harrowed in by the cultivator or smoothing harrow, care being taken that they are sown evenly. If the plowing has been recent, the last smoothing may serve to cover them. In case it is necessary to sow the cowpeas after the planting of the abacá, it will be necessary to wait until the abacá is up when they may be sown broadcast as in the first case and covered with the cultivator, passing the latter between the rows of abacá.

The abacá should be planted immediately after the cowpeas, or at least before they are up, in check rows at a distance of 3 meters. The first operation is to mark off the field. For this a tape and a supply of small, rough stakes will be necessary, the latter to mark the position of the hills of abacá. Where fields of some size are to be planted, a long wire tape would be useful. This may be made of light wire and every third meter marked by a ring, link, or in some other manner. With the tape, lay off a base line along the longest side of the field and mark it off into 3-meter lengths by the stakes. At one end of this line and at right angles with it, lay off another line along the end of the field, marking this line also into 3-meter lengths. Next, by placing one end of the tape at the second stake in the base line and passing it (the tape) through a point 3 meters from the farthest stake in the other line, a second row of stakes may be added. This row of stakes will represent the second row of abacá. If this process is continued across the whole field, it will be laid off into 3-meter squares, the corners of the squares (marked by stakes) being the positions of the hills of abacá. Holes, 20 to 30 centimeters in diameter and 30 centimeters in depth, should then be dug at the location of each stake for the reception of the plants.

For planting, abacá rootstocks should be used; that is, the underground part of the stalk. These may best be secured by digging up the entire plant and then cutting off the stalk, the cut to be made about an inch above the crown of the root. The best rootstocks come from plants which are not too old and rootstocks which are 12 to 15 centimeters in diameter at the top are better than larger or smaller ones. Each should have at least three healthy buds. In practice, when two or more fields are to be planted in one season, the clearing of the second field can be postpond until the first is planted. Rootstocks may then be secured from the second field to plant the first. In some cases also, if the preparation is done quickly and is immediately followed by the planting, the rootstocks from the same field may be used for replanting. They will keep for some time. In planting the rootstocks, one should be placed right side up in each hole and covered, not too deeply, but at such a depth that the top will be about 5 centimeters from the surface of the ground.

It might be well to explain the reasons for using rootstocks instead of large or nearly mature plants as is the usual custom. Plants developed from the buds of a rootstock are usually much stronger and faster growing than those from a large plant. When the latter is transplanted, the roots are damaged and most of the energy of the plant goes to keep it alive. Rarely more than one or two suckers develop and they, being ill nourished, make a slow growth. By the usual methods the use of large plants might be justified since the little plants growing from a rootstock in the midst of grass and weeds, would probably die unless mothered by an older plant until they were able to take care of themselves. There are no weeds, however, with these methods and at the end of a year, there would be several good-sized plants each with its own root system, while with the other method, there would be one worthless stalk and a few small suckers.

At this point may properly come the question of shade trees. There is no experimented evidence on this question. Their value in any case would depend largely on the season and on the usual distribution of humidity throughout the year. In the Bicol Provinces, the consensus of opinion among the abacá growers is that they are of considerable value but not absolutely necessary. In those provinces, there is a distinct dry season and sometimes droughts of greater or less severity. Probably a judicious use of shade trees would be advantageous, not only for shade but for the protection they would give from high winds. If used, they may be planted at any time after the planting of the abacá, in check rows at a distance of 21, 25, or 27 meters, depending on the size that the tree will reach at maturity. These distances have been chosen so that the trees may be planted within the rows of abacá, giving at little trouble as possible in cultivating the field. The variety or varieties chosen should be from the three or four generally accepted as the best for this purpose. There are two varieties of dap-dap (*Erythrina indica* Lam.), leguminous trees, which are good; and there are one or two other good varieties. A shade tree to be of value should be deep rooted, quick growing and have a wide low head which does not give too heavy a shade. It is almost necessary that they be leguminous. There is a growing custom in the Bicol Provinces of planting pili trees in the abacá fields. The pili tree is not a good shade tree and it robs the abacá of food material and would, therefore, be detrimental to the latter. It is possible, however, that the income from the nuts would more than offset the loss in abacá. This question will have to be left to the experience and judgment of the grower.

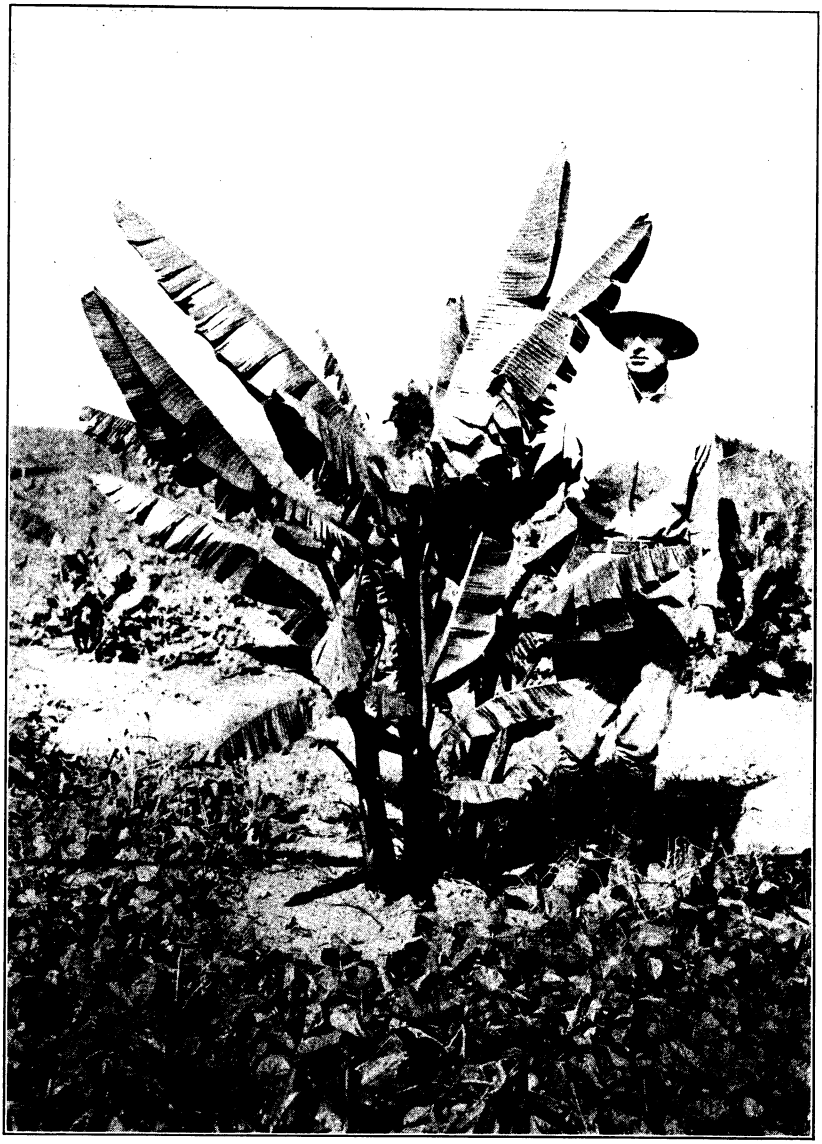
From the planting of the abacá, the field should need no attention (shade trees excepted) until the cowpeas have matured, a period of three to three and one half months. At this time it will be necessary to harvest the crop of cowpea seed so that it may be available for replanting. The pods may be picked by hand and afterwards threshed. The vines should at once be turned under with the plow to serve as a green manure. Some care should be taken in turning them under. If they are very rank, it would be well for a man to follow the plow to lay them along the furrow. Otherwise, they will gather in bunches in front of the plow and those which are not covered will catch on the cultivator when the cowpea seed is covered.

A second crop of cowpeas should be planted very soon after the vines are plowed under. This may be done in the same manner as before, by sowing them broadcast and overing them with the cultivator. If the supply of seed is insufficient for this, it may be sown in drills, three rows of cowpeas between each two rows of abacá. The drills may be marked out by the plow and the sowing and covering done in one operation, the covering being done by the feet. The first method is preferable, for in the latter, weeds may spring up before the cowpeas completely cover the ground.

The process of replanting the cowpeas should be continued for a period of fourteen to eighteen months. When a crop of cowpeas matures it should be harvested, the vines plowed under and the crop promptly replanted. At the end of the eighteen months, or earlier in some cases, the abacá will be so large and the hills so wide that animals passing between the rows will break the abacá; furthermore, the grounds will be so shaded that the cowpeas will not grow.

It is well to note what would be accomplished by the use of the cowpeas. First, the field is thoroughly prepared and cleared of all weeds. Then follows the planting of the cowpeas and the abacá. Within a week the cowpeas will be well up, and within three weeks they will completely cover the ground.

Since the field was thoroughly cleared of weeds in the first place, they will not start for some time and those that do spring up later will be choked by the thick matlike growth of the cover crop. If each crop of cowpeas is replanted as soon as mature, it will result in a field free from weeds for the whole period of eighteen months. The cost of this will have been the cost of



Six-months-old abacá plant grown on an old plantation with the new method.
Cowpea cover crop in foreground. La Carlota Experiment Station.

PLATE III.

Old abacá "late" (plantation) in southern Luzon, showing average condition of these plantations.

harvesting, plowing and replanting the cowpeas three or four times a year, a very reasonable expense. From four to six crops will have been incorporated in the soil, each returning not only what it took out but the nitrogen which it absorbed from the air. The effect on the physical condition must also be considered. The vines, plowed under, add so much decaying vegetable matter or humus to the soil, a substance making it light and friable and most favorable for the growth of most of our domestic plants. Soil in this condition will absorb water readily and a larger part of the heavy precipitations during the rainy season will soak into the ground instead of running off. In the case of a bad drought, this one factor might be of great value. No other crop can take the place of the cowpeas. Camotes which are frequently planted when new ground is cleared, while they help somewhat in keeping down the weeds, do not make the rank growth of the cowpeas and not being leguminous, they reduce the fertility of the soil rather than add to it. Peanuts and some other leguminous crops could be used but generally their growth is not heavy enough to give full protection from weeds. Mongo is probably the only substitute that could be used successfully but this crop has not been proven entirely satisfactory in many localities. It is seen, then, that the cowpeas serve several purposes: They take the place of a large amount of cultivation that would otherwise be necessary; they act as a fertilizer, adding more plant food to the soil than they take out; and they improve the physical condition of the soil, indirectly also, and lessen the danger of a drought by increasing the asbortion of moisture.

At the end of eighteen months the cowpeas may no longer be planted. The abacá will have attained considerable height and the hills will have spread until practically all of the ground is shaded. The field should average not less than 15 stalks to the hill. The stalks will not have attained their greatest size until a year or two later but what is of greatest importance, they will be in an actively growing condition. Well nourished from the beginning, they will develop much faster than abacá grown under ordinary conditions and weeds, if they eventually creep in, will have less advantage over them. They will have a resilience, a latent force, to recover quickly after a severe drought, typhoon or any other destructive force over which the planter has no control.

Cultivation may be discontinued from this period until after the fourth or fifth year or until the field has been harvested three or four times. The harvesting of the mature stalks allows the sun to penetrate to the soil and steps are again necessary to prevent the growth of weeds. This may best be accomplished by using the plow and cultivator. If, as the field grows older, the plow and cultivator are impracticable, regular and systematic use of the hoe may be resorted to. The bolo method which is practised at present has never been effective.

The above methods are based upon agricultural principles which have been well tested and which are succesfully used to-day in actual practice. The only doubt that the abacá grower can have is one of financial success. Every crop has a limit where increased care and cultivation will not bring increased profits but in the production of abacá, care and cultivation are practically nil. A certain amount of cultivation, judiciously applied, should well repay itself. The average yield of fiber per hectare in the Islands is less than 380 kilos (6 piculs) and it is doubtful if the best of the ordinary "lates" in the Bicol Provinces exceed 575 kilos (9 piculs) per hectare. By the above methods, under ordinary conditions, a planter should be able to harvest about 650 kilos (10 piculs) per hectare the third year and 1,000 kilos (16 piculs) or more, thereafter. Just how long a field cultivated by the above methods would hold its superiority would depend upon how clean it was kept, how heavily the abacá was cut, and other factors, but it should turn out more than the ordinary crop for a period of about fifteen years.

A planter considering the adoption of these methods should not think that he has to grow all his abacá under this system. Nearly every planter has a few "lates" which have been recently cleared and planted or which are favorably situated with regard to fertility, the yield of which is above the ordinary. He may also have some that are situated on steep hillsides or that are very rocky, which would make cultivation like the above exceedingly difficult. Such fields may be left while attention is given to the older and more impoverished. Almost without exception these are the ones which may be most easily cultivated. The best plan would be to clear and plant a number of hectares each year, say, from 5 to 10, according to the ability of the planter. Even 2 or 3 hectares a year, in ten years, would convert his worst "lates" into the best on the hacienda. It should be realized that after the second year, returns will begin to come in, and by the fourth year, a field should have paid for the original expense and any other expenses dependent upon the use of these methods.

The following is a fair estimate of the cost of clearing, planting, and cultivating 1 hectare of abacá up to the end of the eighteen months. Sixty-five centavos, without meals, has been taken as the daily wage for laborers.

Clearing	₱30	
Plowing and harrowing	10	
Preparing rootstocks and planting cowpeas and abacá	25	
Total preliminary expense		₱65
Plowing under and replanting cowpeas four to six times during the first eighteen months		20
Total expense, clearing, planting and cultivation during the first eighteen months		85

The aforementioned cultural methods have special reference to the renovation of old abacá fields. With slight modifications in the preliminary preparation, they may also be used advantageously in the planting of new land. It should be understood that the methods have not been described completely in every detail. These may be worked out by the planter himself to suit the peculiar conditions on his plantation. The main points, however, should be carried out and the planter should not forget that absolutely clean preliminary cultivation is the foundation upon which these methods are based and the proper use of the cowpeas is necessary for their successful operation.

CURRENT NOTES.

NOTES BY P. J. WESTER, Horticulturist in Charge of Lamao Experiment Station.

IMPROVEMENT OF CACAO IN THE PHILIPPINES.

Since 1911 cacao improvement has been one of the projects of the Bureau of Agriculture, but principally on account of lack of funds and personnel work could not be taken up in the field, and until this year the work on this project has been confined to experimental work in shield budding at the Lamao experiment station. These experiments were carried to a successful conclusion by the close of 1913, the results of which were communicated in a paper (The Buddage of Cacao) published in the January, 1914, number of the REVIEW. Since then steps have been taken to demonstrate the value of budded cacao trees to the cacao planters, and when this note reaches the reader selection work will have begun in the cacao district of Silang, Cavite. Through a coöperative arrangement the Bureau of Science will carry out the fermentation of the cacao pods from the selected trees, make the quality tests, etc., and topworking young seedlings will be started in the field as soon as the necessary data relative to the productiveness and the quality of the product of certain trees have been brought together. Silang has been selected for the initial work largely because of its accessibility from Manila, but this work will be extended to the other cacao-producing sections of the Archipelago as rapidly as funds permit. In the meantime the Bureau will be glad to hear from any one who is interested in the improvement of cacao. Communications relative to productive trees with cacao of good quality are particularly desired.

ANOTHER NURSERY PEST.

Judging from the experience of four seasons at the Lamao experiment station, the Heteropterous insect *Helopeltis antonii* Watrh. (so identified by Mr. J. T. Zimmer, assistant entomologist of this Bureau) is in the future apt to prove one of the most serious enemies to all annonaceous plants, mangos, and avocados in plantsheds in sheltered and shady situations. The insect is a soft-bodied, orange-colored, flying, sucking insect that attacks the tender growth of the plant, sucking out the juice and poisoning the tissues with the result that the tops wither and die. The insects appear a short time before the advent of the rainy season, and while they may be present in so few numbers that it does not seem worth the while to spray, the damage they inflict is surprising.

The same insect has been found on cacao by the writer in Laguna, Batangas, and Cavite. Here they attack the immature pods, with the result that if the insects are at all numerous, the pods blacken and drop causing considerable financial loss. It is doubtful whether the insects can be controlled in the nursery where they are more or less on the wing, but on the cacao, where particularly the young wingless insects congregate on the pods and on the stems and branches it is believed that they could be easily destroyed by a weak contact spray (for formulas see Circular No. 12 of this Bureau).

THE SAGO PALM.

For all practical purposes the world's consumption of starch and related products is derived from annual cereals or rootcrops, the cultivation and handling of which have arrived at a greater or less degree of perfection in the countries where these crops are grown, but one of probably the oldest sources of carbohydrates, the sago palm, is still in the same stage of development, agriculturally speaking, in which it was when the first savage discovered its food value. The extraction of sago is likewise in a primitive stage, and, while there have been some speculations relative to the possible profits of a sago plantation, as far as the writer is aware, the plant has never been domesticated or any sago plantations established anywhere. This is rather a curious fact when it is considered that a study of the habits of the plant tends to show that it will grow admirably on swampy, inundated land which is useless for practically all other agricultural crops and consequently of little monetary value, and that once established a sago plantation would require but little care aside from occasional thinnings of the suckers, and the cutting of the palm trunks for the manufacture of sago.

While it is true that the methods employed are crude, nevertheless there is sufficient sago extracted from the sago palm to make it a more or less steady article of export from Malaysia (the Philippines excepted). Here the sago swamps have never been exploited; in fact, according to statements made to the writer by inhabitants near the sago swamps in Agusan, Mindanao, sago is seldom extracted from the palm except in times of famine, surely an annual, absolute and considerable waste of wholesome, palatable food, when we reflect that the life of a palm is comparatively short, and that the starch is dissipated in its fruition. Perhaps it should be stated that while sago is obtained from other species of palms also, from a commercial standpoint, all sago is extracted from the true sago palm, *Metroxylon sagu* Rottb., which is the species herein considered.

There are two varieties of the sago palm, one, which is armed with spines on the petioles, attaining a height of 7.5 to 15 meters, and one variety that is unarmed and considerably smaller in stature, by some considered a separate species (*M. leavis*). Both kinds have creeping stems from which suckers issue freely and grow into trees. The flowering takes place when the plant has attained its full size and the tree dies shortly after the maturity of the seeds. For the extraction of sago the tree should be cut when the flower spikes make their appearance as the starch stored in the trunk is expended during the flowering and fruiting season.

The sago palm thrives best in a humid atmosphere, with a fairly evenly distributed rainfall, in rich moist soils. Annual inundations of fresh water do not injure it.

In the Philippines the most extensive sago swamps are located along the Agusan River and its tributaries as far as Veruela, and the plant probably extends from there southward to the Davao Gulf, and grows probably also in the Cotabato Valley. The species occurs in Cebu between Carcar and Argao, and a few specimens were seen this year in Bohol, under conditions that indicate the capability of the plant to succeed even where there are dry periods, provided the soil is congenial.

Several works on tropical agriculture consulted give no definite data relative to the time required by a palm to attain full maturity, but from the observations made, 15 to 25 years is probably a fair estimate of the age of a palm when it is ready for the extraction of sago. According to Watt's "Economic Products of India," the yield of sago per plant has been stated to be 70 kilograms. Aside from its value as a source of sago, while the palm grows up the leaves may be utilized for thatching like the leaves of the nipa palm; in fact, the sago leaves are far more durable than nipa leaves for this purpose.

If, as is probably true, the individual seedlings vary in the quantity and quality of sago, the establishment of sago plantations by the planting of suckers would be preferable to a seedling plantation, and fortunately the production of suckers is very abundant, so that the rapid extension of a particularly desirable variety would apparently meet with no very great difficulty. In 1912 the writer brought several suckers to Manila from Mindanao, and if due care is taken in transplantation there should apparently not be an excessive loss of plants in setting out a field. A space of 5 meters apart each way would be the proper distance, which would require 400 plants to the hectare. During the first three or four years the land about the plants should be clean cultivated, but once thoroughly established a plantation would require little care beyond the repression of an undue number of suckers, which if not kept in check would be apt to retard the growth of the palms for sago.

Altogether then, considering the large amount of rice, starch, etc., which is annually imported into the Philippines, and that the sago palm is already profitably exploited for sago in our neighboring countries, that it is the source of a wholesome, palatable food in demand both at home and by the world's trade, and that it grows wild in considerable quantities in the Archipelago, attention is being called to the sago palm as being certainly a neglected industrial opportunity, which, properly handled, might have a bright agricultural future, and therefore worthy of further investigation.

A SERIOUS DISEASE ON CITRUS FRUITS.

From present indications the scab (*Cladosporium* sp.), referred to in Bulletin 27, Citriculture in the Philippines, is apt to become one of the worst diseases on the citrus trees in the nursery that the future nursery man in the Philippines will have to face. This is the third season that the scab has made its appearance in the citrus nursery at the Lamao experiment station, attacking every species in the genus. It does not confine itself to small plants, but spreads to the budded good-sized trees in the orchard. During the dry season the scab is readily controlled by Bordeaux mixture, but with the continuous rains during the wet season very little can be accomplished by spraying, the spray being washed off before it can make a good "stick." Evidently it would be good insurance practice to make a thorough application of Bordeaux mixture to the young citrus trees just before the advent of the rainy season.

TWO PROMISING PLANT IMMIGRANTS.

Two more plant introductions made by the Bureau of Agriculture have evidently come to stay, the cattley guava, *Psidium cattleianum* Sabine, and the carissa, *Carissa arduina* Lam., both introduced in 1911.

The cattley guava is a shrub or small tree, attaining a height of 6 meters, with dark green, leathery, shining leaves, indigenous to Brazil. The fruit is subglobose, 2.5 to 3.5 centimeters in diameter, claret red, and smooth; the flesh is white, juicy, sweet, subacid, aromatic, and of excellent flavor, and contains many small seeds. Season, July.

The carissa is a spiny shrub, attaining a height of 1.5 meters or more, with small, glabrous, stiff leaves, indigenous to South Africa. The fruit is 3.5 to 4.5 centimeters long, more or less cylindrical oblong, with acute or obtuse apex, smooth, dark red, thin skinned; the flesh is red, juicy, subacid, and of excellent flavor; seeds many, small and flat, in central cavity of flesh. Season, January to May.

The cattley guava and the carissa are both attractive evergreens, and being native to the cooler regions of the Tropics it is probable that they will succeed best at an altitude of 450 or more meters, though they have fruited at sea level at Lamao. The fruit of both species may be eaten as dessert fruits or made into preserves.

The carissa makes a good "live" fence, and is readily propagated from layers merely by throwing a little soil over the branches that spread over the ground, which then root within a few weeks and may be severed from the mother plant and transplanted. Thus seedlings of particularly desirable habit or with unusually large and well-flavored fruit are easily propagated.

The cattley guava is propagated from seed but it is very likely that this species, like the common guava, may be shield budded.

THE ROSELLE IN HAWAII.

The fact that there is a growing interest in roselle as a commercial crop in the Tropics is indicated by various items in different publications that have appeared within the last few months.

The Queensland Agricultural Journal has published a long article on the culture, etc., of the plant, and in the annual report of the Hawaii experiment station for 1913, we find the following statement:

> For several years there has been a demand for dried roselle beyond what could be furnished from the small patches of this plant heretofore grown in Hawaii. In the experiments of the station it was found that roselle grew very satisfactorily between the young rubber trees and elsewhere. An area of 100 acres (40 hectares) was planted this year to roselle for the purpose of obtaining the dried product for use in the manufacture

of jam and jellies. One jam manufacturer has found it possible to pay 40 cents (80 centavos) for the dried product, and this price yields a reasonable return to the grower.

A communication has also been received recently from Mr. W. A. Anderson, of the Nahiku Rubber Company, Limited, Maui, Hawaii Territory, in which he states that "about 220 acres (88 hectares) have been planted this year to roselle in Hawaii for commercial purposes. This is to be dried and shipped to the mainland (United States) to be made into jams, jellies, and soft drinks. The price contracted for is 30 cents per pound of dried product, at which prospective growers do not appear to see much profit in the crop. As an intercrop among rubber trees, however, it proved sucessful last year."

Compared with other crops this acreage is of course insignificant, yet the increase in acreage in one year of 120 per cent is worthy of notice.

It may not be inopportune to here recall the fact, previously published in this REVIEW (May, 1913), that in the experiments made by the Bureau of Agriculture in 1912 at the Lamao experiment station, in connection with the experiments in wine manufacture from the herbage of roselle by the Bureau of Science, a yield of 17 metric tons of herbage and 6 tons of fresh fruit were obtained from one sowing per hectare per year and that "about 100 kilos of herbage and 75 kilos of sugar make 300 liters of wine, while an equal amount of herbage furnishes approximately 200 liters of sirup, depending upon the quality of the herbage at the time of cutting."

There is apparently a demand in the United States for roselle products, or preserving factories would not buy the dried article from Hawaii. It would seem that there would be room for several small preserving factories in various centrally located points in the Archipelago, which, with fruits ripening at all seasons of the year, could be running practically without interruption, while in the United States they are running only a few months of the year. In a small way fruit preservation is certainly one of the neglected industrial opportunities of the Philippines, and one that properly directed could easily grow to considerable magnitude.

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Sisiman Matadero	H. H. LADSON, Veterinarian, Superintendent.
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[1] On special detail.

[2] On leave.

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